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The International Journal of Orthodontia

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VOL. I ST. LOUIS, DECEMBER, 1915 NO. 12

ORIGINAL ARTICLES

THE SURGICAL CORRECTION OF CERTAIN TYPES OF ORAL DEFORMITIES.

BY M. N. FEDERSPIEL, D.D.S., M.D.

Professor of Oral Surgery and Orthodontia, Marquette University, School of Dentistry, Milwaukee, Wisconsin.

WHILE orthodontics has done much to correct malocclusion and dento-facial deformities it must be conceded that here and there we are confronted with certain types of extreme oral and facial deformities which cannot be successfully treated, or greatly improved, by orthodontic treatment without the aid of surgery. Clinical experiences have proven that the results in the correction of malocclusion are at their best during the period of tooth eruption; that after the teeth have fully erupted the prognosis is not very favorable, especially in case of extreme malformations. Orthodontics has its limitations, it must not be considered as a panacea for all forms of oral deformities complicated by malocclusion. Fortunately surgery offers much as an aid to orthodontics in giving relief to those unfortunate ones who through neglect, poverty and ignorance are the victims of progressive malocclusion, who, upon adolescence are examples of a crippled dental arch, mal-formed jaws and distorted facial lines. In order to illustrate more fully of the condition derived through surgery I have the following cases to report:

Case I.—Miss J.— age 27 years—occupation, factory employee—complaint, inability to close the lips normally. She had a pronounced malocclusion and dento-facial deformity (see Fig. 1) complicated by the loss of the maxillary first bicuspids and the right mandibular first molar. Had this case been treated during the period of tooth eruption the result, no doubt, would have been ideal. In order to correct this deformity I decided that the quickest and best permanent result could be obtained by a combined orthodontic and surgical treatment. On account of the first bicuspids being lost I retracted the cuspids with an orthodontic appliance. After about eight weeks I succeeded in shifting the cuspid distally so that it was in contact with the second bicuspid. She was then referred to the hospital to undergo

pre-operative treatment. The following morning under ether anæsthesia I freed the mucoperiosteum labially and lingually from the protruding alveolar process, then with the aid of a surgical drill I removed the entire protruding

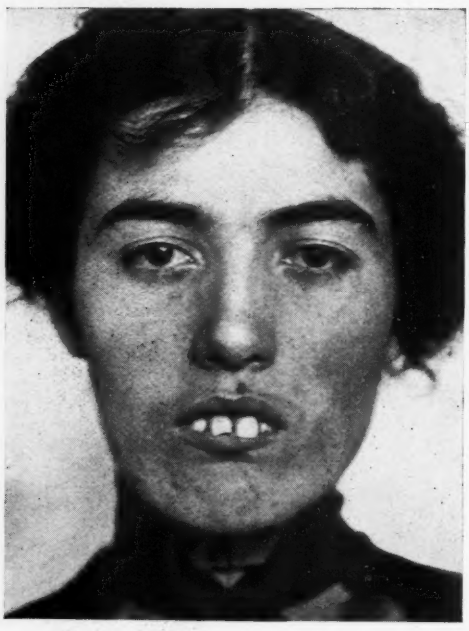

Fig. 1.—Pronounced distoclusion complicated by extreme labio-version of the upper anterior teeth and excessive formation of the alveolar process.

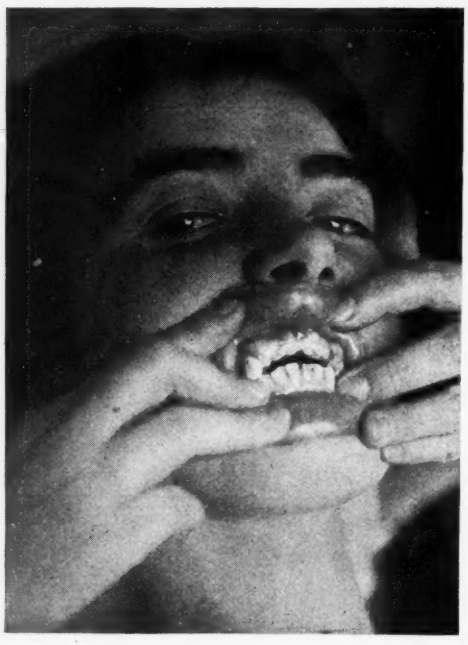

Fig. 2.—After the protruding mass in the upper jaw was removed and the cuspids shifted distally to take the place of the extracted first bicuspids. The mucoperiosteal flaps were trimmed down so that they could be approximated.

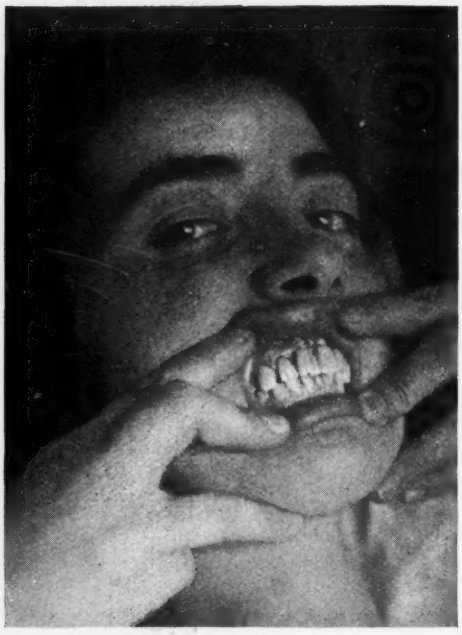

Fig. 3.—Showing four artificial incisors inserted in the form of bridge work extending from cuspid to cuspid.

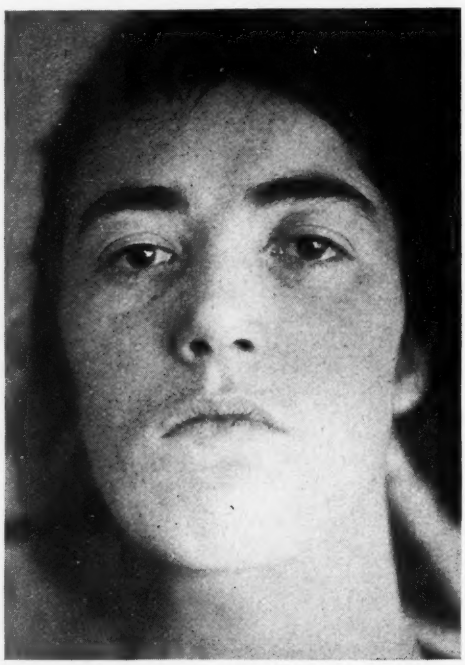

Fig. 4.—Result after operation. Note the closing of the lips without effort and the slight wrinkle of the vermillion border of each lip.

mass including four upper incisors (see Fig 2). The flaps were trimmed down so that they proximated and then tied together with silk. Six days after the operation the stitches were removed. Two weeks later she was ready to report to her dentist to have four porcelain teeth inserted in the form of a bridge extending from cuspid to cuspid. (See Figs. 3 and 4.)

Had this same patient been placed under the care of a competent orthodontist during the time her teeth were erupting there would in all probabil-

Fig. 5.—A complete cleft palate and hare lip.

A B

Fig. 6.—(A) Plaster cast before operating, showing divided upper arch. (B) Plaster cast after operation and the arch ready for orthodontic treatment.

ity not have developed so pronounced an oral deformity as is shown in Fig. 1. Orthodontic treatment at her present age, no doubt, might have improved her condition; but I doubt very much if the improvement would have been any better than that under surgical care. Another reason why I advocate such a radical step is because the lady could not find sufficient time to make regular visits to the orthodontist for treatment and then the financial end was to be considered—she is a factory employee—a wage earner, one of the many thousands who is dependent upon her daily labor for food and shelter.

Case II.—Miss Ester M.—age, nine years—had congenital cleft of the lip, alveolar process, hard and soft palate (see Fig. 5). The alveolar process is divided between the left central and a rudimentary left lateral. The alveolar process on the right side was turned outward and protruded to such an extent that it caused a distortion in that region. In order to obtain the best result possible it was necessary to close the alveolar cleft first in order to correct the dental arch; so that at a later time the malposed teeth may be placed in correct alignment by orthodontic care. (See Fig. 6).

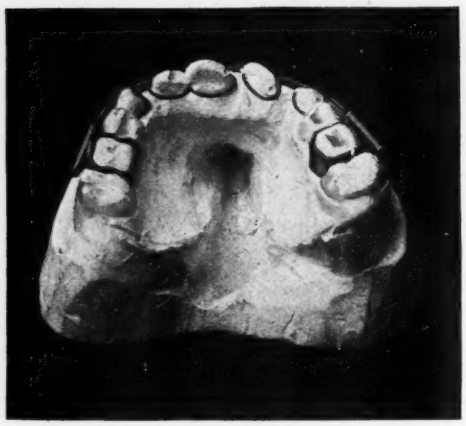

Fig. 7.—Showing method of immobolizing the fractured bone with an alignment wire to which the anterior teeth were ligated.

Fig. 8.—Hare lip. Note the width of the cleft. This same cleft became more narrow after the alveolar cleft was closed as shown in Fig. 7.

Fig. 9.—Result after the operation. This photograph was taken eighteen months after being operated.

Fig. 10.—Another view of same patient after being operated.

Under ether anæsthesia an incision was made between the right deciduous cuspid and the right permanent lateral. The mucoperiosteal flaps were raised and retracted and the exposed bone was cut one-half its thickness by a narrow long fissure bur, then by forcible pressure the protruding alveolar process containing the lateral and the two centrals, was brought in contact with the alveolar process on the opposite side; thus producing a green stick fracture.

The contact surface was then freshened and the bones brought together. In order to immobolize the fracture I slipped an alignment wire, guage 18, into the tubeing on the bands which I had previously cemented on the maxillary first molars. The anterior teeth were then ligated firmly onto the alignment wire (see Fig. 7). Four weeks later the appliances were removed as healing had taken place.

This operation restored to a fair degree the shape of the dental arch,

Fig. 11.—Photograph of infant boy, six weeks old, showing a complete hare lip and cleft palate.

Fig. 12.—Photograph of same patient after the alveolar cleft and hare lip was closed surgically.

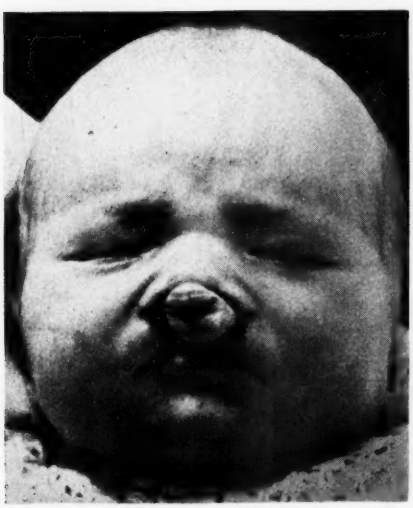

Fig. 13.—Photograph of infant boy, 20 days old, showing premaxillary bone protruding and attached to the tip of the nose.

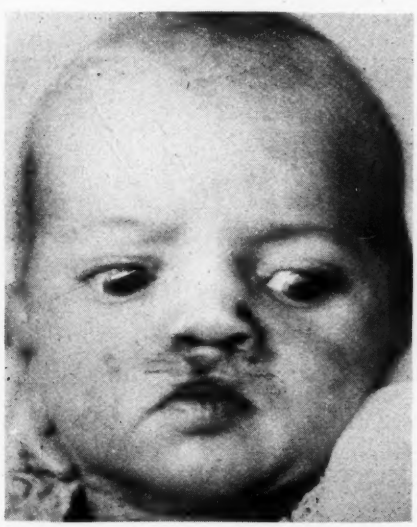

Fig. 14.—Photograph of same case as shown in Fig. 13, taken a few hours after the stitches were removed.

(see Fig. 6B) and as a result, the cleft of the lip became more narrow. When I operated upon this patient a second time for the correction of the cleft of the lip (see Fig. 8), I obtained a better result than if I had attempted closing the lip before restoring shape of the dental arch. (See Figs. 9 and 10.)

Case III.—Infant boy, six weeks old, had a complete cleft of the soft and hard palate, alveolar process and upper lip. The degree of this deformity was similar to Case II.

The cleft was very wide and the alveolar process on the right side protruding outward; making the deformity appear very pronounced. (See Fig. 11). On account of the child not being able to nurse well I closed the alveolar cleft and lip in one operation. This was done by bending the protruding bone until the alveolar cleft was closed and held so by silver wire, gauge-22,

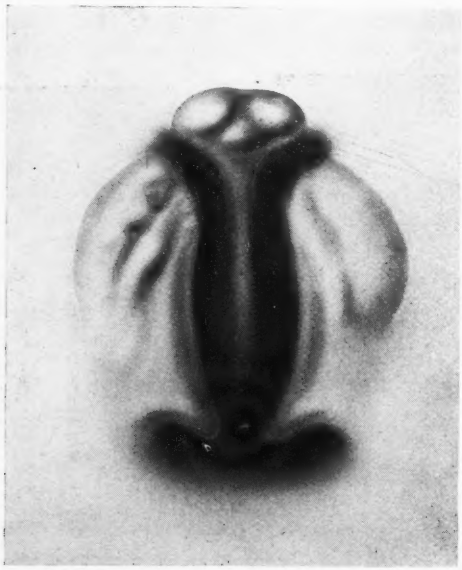

Fig. 15.—A drawing of the palatal view to show the double cleft and protruding premaxillary of patient shown in Fig. 13 before operating.

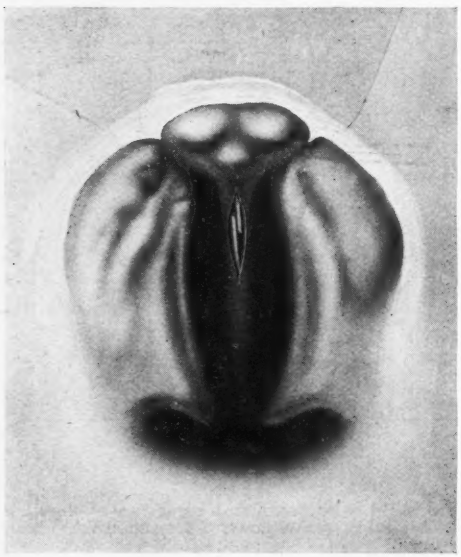

Fig. 16.—Showing the vomer cut so that the premaxillary bone could be forced into its normal position.

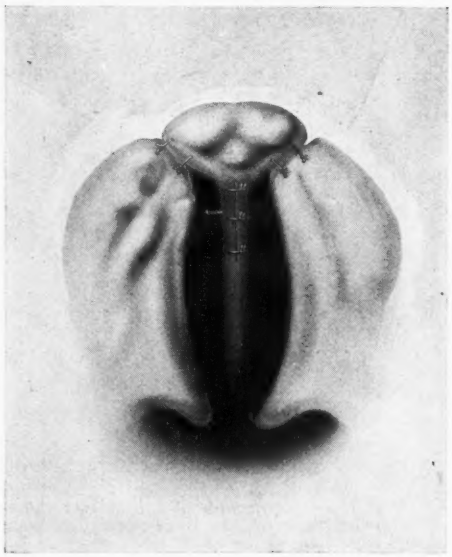

Fig. 17.—Showing the premaxillary bone wired in its new position.

being passed through the bones and twisted. The lip was then closed in the usual way. (See Fig. 12.) This method of surgical correction will prevent the child from having a divided dental arch. While some of the teeth, no doubt, will erupt in malposition, it will be an easy matter to correct same by orthodontic methods.

The cleft of the hard and soft palate has since been closed by doing a Langenbeck operation.

Case IV.—Infant boy, 20 days old (Figs. 13 and 14). Had a cleft extending through the soft and hard palate up to the anterior palatine canal where it bifurcates to form a double alveolar cleft and double cleft of the lip. The premaxillary bone is displaced forward so that it rests close to the tip of the nose. This type of oral deformity is of the most pronounced kind. Yet when operated upon at an early age the prognosis is very favorable. This boy I operated upon twice within ten days. In the first operation I did a submucous resection and cut the vomer. This permitted forcing the displaced premaxillary bone backward so as to form a satisfactory alveolar arch. (This was done after denuding the surfaces that were to come in contact.) The bone was held in its new position by passing a silver wire, gauge 24, through the vomer on each side of the wound, (see Figs. 15, 16 and 17). In this way I was able to hold the bone in its new position without

Fig. 18.—Photograph of infant girl, 4 weeks old, showing double alveolar cleft and a complete cleft of the lip on the left side. The cleft of the lip on the right side did not extend to the floor of the nose.

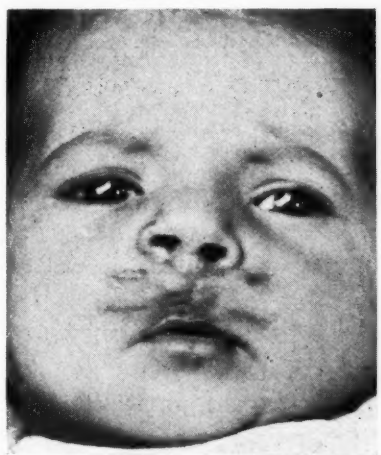

Fig. 19.—Photograph of same patient after the operation, taken a few hours after the stitches were removed.

injuring the unerupted teeth. As an added precaution, an adhesive strip was strapped over the premaxillary from cheek to cheek. Healing took place so rapidly that nine days later I removed the adhesive strip and surgically closed the double cleft of the lip.

After seven days I removed the stitches and two days later the patient left the hospital to return not later than a year to have the cleft of the hard and soft palate closed.

Case V.—Infant girl, four weeks old. (See Fig. 18.) Had a cleft extending through the soft and hard palate up to the anterior palatine canal where it bifurcated to form a double alveolar cleft and double cleft of the lip. This deformity while very similar to Case IV is not so pronounced. The surgical treatment in this case was the same as in Case IV. Figure 19 is a photograph of the little girl which was taken a few hours after the stitches of the lip were removed.

The above cases referred to should be sufficient to urge orthodontists to give more consideration to these extreme oral malformations. Unfortunately orthodontists pay little or no attention to the benefits that can be derived through surgery, while oral surgeons give little or no consideration to the science of orthodontics. These two specialties are so closley related that one cannot progress without the knowledge of the other in successfully treating many of these pronounced oral malformations.

THE RELATION OF ORTHODONTIA TO DENTISTRY.*

By Frederick Bogue Noyes, B.S., D.D.S.
Professor of Orthodontia and Histology, University of Illinois, College of Dentistry, Chicago.

THE present is an age of specialization. Knowledge and skill have made such rapid advancement that it is impossible for any man to compass the whole range of knowledge or excel in many fields of execution. The engineer must decide whether he will follow some line of machine construction, factory construction, the development of hydraulic power, electrical power, the reclamation of land, or some other field of constructive endeavor. The physician must choose the study of the eye, the ear, the nose and throat, the stomach, the genitourinary tract, or some other field. So also the dentist must choose between the treatment of the diseases of the hard tissues of the teeth, the treatment of the soft tissues, the construction of artificial dentures, the correction of malocclusion, or the extraction of teeth, for he cannot hope to excel in all of them.

This development of specialization demands a foundation of broad knowledge and skill, and their application in a limited field. No matter how limited the field of application, knowledge of the fundamental sciences must be broad. No man can hope to push forward the knowledge of the bacteriology of the mouth without a good foundation in general bacteriology. No one can be a good oral surgeon without a knowledge of the fundamental principles of general surgery, and training and experience in its technic and practice.

To rise out of mediocrity to a position of distinction, today requires vastly greater effort and attainment than a century ago. This is true because every specialized field is drawing from every department of science with increasing efficiency, applying the fullest development of each science to the accomplishment of its own end, and every department of science has made such rapid progress in the last few years that it would be impossible for any one to excel in them all. It is a mistake, however, to suppose that every new discovery in a department of science is revolutionary and destroys the work that has preceded it; and one who has once mastered the fundamentals of science, may keep in touch with its advancement with comparatively little effort while he would not be at all in a position to carry on a new work in this field, to be in the vanguard pushing that line still further into

*Read before the Illinois State Dental Society, May, 1915.

the unknown. There always has been and there always will be two types of minds: the encyclopedic and the logical types, and each has its sphere in the development of any profession or science. The man with the encyclopedic type of mind knows and remembers what everyone else has said and thought on his particular subject. He can tell you when this article was published by that man and another article by another man and just the point of view of each individual. But when he attempts the investigation of a new field he is very apt in generalizations to miss the most important points and just as likely to emphasize the unimportant details and miss entirely the one central thing. In contrast to this type, the logical type compares accurately, sees clearly all individual facts, and recognizes the generalizations that can be drawn from them. He thinks clearly and works out an individual philosophy or interpretation of the facts to the best of his ability and in so far as he goes, truly, but he may be entirely ignorant of what any one else's opinion has been in the same field. To a certain extent these two types are contradictory but they are not necessarily so. To draw a comparison from current military tactics, the encyclopedic type may be compared to the general who, conscious and posted continually as to every point and as to what is going on throughout the entire line, is not in direct contact with the men at all, and the officers who, entirely ignorant of what is going on at any other point on the battle front, are engaged only in pushing forward the attack, at their own particular points. In the development of a profession and the training of men for the pursuit of highly specialized fields, the broadness of the preliminary training should be emphasized to counteract the narrowing tendency of the intensive following of a limited field. The training should be planned not simply to develop the highest degree of efficiency, and attain the most rapid advancement in a special field, but to keep the specialty in touch with the general profession and co-ordinate it with other specialties for the benefit of humanity.

The development of specialization as it is today, has brought about the interdependence of the general practitioner of dentistry and the various specialties. And for the first time, it has brought the dentist into the same relationship to the diagnostician and the internal medicine man as are the other specialties in medicine. Now, for the first time, the physician is looking for and expecting the same co-operation from the dentist that he has been accustomed to look for and receive from the oculist, the rhinologist, and other specialists. A physician, finding a patient suffering from some condition which he knows to be caused by some local infection or inflammation refers the patient to the dentist for a report on his oral condition, just as he refers the patient to the rhinologist for a report on the mucous membrane of the nose or the condition of the tonsils. The physician, in that case, is not concerned with the teeth as a masticating apparatus, but he wishes to know if there is any pathologic condition present, and if so, an intelligent report as to its character and extent, that he may have some judgment as to its relation to the general pathologic condition. If the dentist replies upon superficial examination that he finds the mouth apparently normal, as a masticatory apparatus, without a detailed report as to the presence or absence of inflammation of the gingivæ, the presence or absence of suppurative pockets on the sides of the roots of teeth, the presence or absence of sup-

purative conditions about the apices of tooth roots, and their extent and character, and certainly if he replies without a radiographic examination of both arches to reveal the possible existence of suppuration within the substance of the bone, he fails utterly from the standpoint of the physician. What the physician wished was the opinion of an expert in the given field's pathology that he could use as a basis for the organization of his campaign for the health and usefulness of the individual, and too often he is unable to get such reports. In such conditions, too, the specialist should remember the general systemic conditions which are present should govern him as factors in determining the character of the treatment to be used for the local condition. In a local suppurative condition, the treatment for a patient not suffering from any systemic condition might be quite justifiable, which would not be justifiable at all for a patient showing manifestations of some grave general condition.

Just as the physican looks to the dentist for expert advice, so one specialist looks to another for the same character of expert judgment. The oculist may call upon the dentist for the same character of advice and treatment as is sought by the intern. The rhinologist, having removed a nasal obstruction and created normal conditions in the nasal pharynx, knows that normal respiration will be impossible until the malocclusion is corrected so that the normal respiratory functions can be carried out. The orthodontist correcting a malocclusion in which teeth or the cusps of teeth have been lost or destroyed sends the patient to the general practitioner, for the restoration of the lost teeth or cusps, knowing that unless this is done the preservation of normal occlusion will be impossible. So the specialist looks upon the so-called general practitioner as a specialist in his department.

To show you the importance of this particular matter, a concrete example is cited. In the correction of malocclusion in the writer's practice, an upper first molar was found in lingual occlusion. It had never been perfectly formed and caries had destroyed all its cusps, an amalgam filling had been made which was as flat as a board. The patient was sent to the general practitioner to have this replaced by a gold inlay that would restore the normal-sized crown and the form of the occlusal surfaces. The patient returned with the gold inlay, beautiful from a mechanical standpoint, with perfect margins, but with cusps that resembled no tooth in heaven above or earth beneath, and from the standpoint of normal occlusion, utterly functionless. With such an occlusal surface, there was no hope of maintaining the normal occlusal relations of that tooth.

I have dwelt upon the development of interdependence among the specialties and of the disappointment that is too often experienced, as the basis of an appeal for better types of specialists in dentistry. In medicine a man would not think of attempting to practice as a specialist without going to those places where material is abundant and devoting time, energy, and money to study under the men of the greatest knowledge and skill, developing there his own knowledge and experience in public clinics and hospitals under the direction of able men, before attempting to conduct private practice of a specialty. In medicine the means of developing and training specialists is a method well developed all over the world, but up to the present time there has been nothing corresponding to it in dentistry.

At present the partisan, I had almost said "charlatan," who travels about the country exploiting some special method of treatment, often backed up by some commercial house, claiming to equip men for the practice of some specialty, are a disgrace to the dental profession, and they exist chiefly, I believe, because educational institutions have failed to offer opportunities for special study and training and because the dental profession has not yet organized hospitals and infirmaries for the care of the poor of the communities who are unable, for financial reasons, to obtain dental service, and which should be the places for special training. There is just as much reason for providing dental service for the poor of any locality as there is for providing hospital service. Every state and public institution should maintain dental attendance as they do medical attendance, and in the future, I believe it will be the function of the state dental societies to organize this service so that it will be the means of training specialists in dentistry, just as corresponding institutions are the means of training specialists in medicine. In medicine, the hospital and public infirmary has grown out of the medical school and the university. In the same way, I believe that the first step is the development in the universities and dental schools of adequate means for training specialists in connection with hospital and infirmary service. Such a development, however, requires the proper point of view of the profession in general. In the past, dentistry has been too ready to accept the short course of a few weeks as a training for special practice and it is a grave question whether men would devote a year's time in the pyorrhea service or the orthodontia service in a dental hospital as men devote a year or two to an intern service in such an institution as the Cook County Hospital, in the eye, ear or surgical service. But I believe that if such fair training could be offered under adequate supervision coupled with thorough courses in the allied sciences, there would be many young men of great ability who would avail themselves of the opportunity.

Orthodontia is a specialty of dentistry, in just about the same sense that dentistry is a specialty of medicine. For the training for general practice of orthodontia does not train a man for the practice of orthodontia any more than the training for medicine equips a man for the practice of dentistry. The good of both orthodontia and dentistry depends upon the admission of this relationship. As evidence of the great development of orthodontia in the last few years, one had only to notice the great number of children wearing appliances and the large proportion of space in dental literature devoted to the subject. But as I view it, there is bound to be reaction. For too large a proportion of the men practicing it are utterly untrained either in the theory or the technic of orthodontia. The result must be an enormous crop of failures. I believe that eventually every fair-sized city will have its orthodontist, supported by the dentists, just as the present time every fair-sized city has its surgeons supported by the general practitioners. But this condition for orthodontia can never come until there are a sufficient number of institutions presenting courses which will adequately train men for practice.

The development of transportation facilities in the interurban electric railroad, and the enormous increase in the use of the automobile, will favor the development of specialists in the smaller cities, for it increases the area

from which specialists may draw patients, but in addition to these favorable conditions, there is needed the growth of a feeling of co-operation between the individuals of the profession in order to maintain a specialist, except in the largest cities. Men in a given locality must allow the one among them with the greatest ability and liking for a given specialty to go where he can receive the special training and practice necessary for the practice of that specialty, and then if possible refer all such cases in that locality to him for treatment. Such a method would be greatly to the advantage not only of the community but of the profession.

THE CAUSE AND EFFECT OF ORAL DEFORMITIES.*

By Dr. A. C. Gifford, Oshkosh, Wis.

WE know by this time that dentistry has begun to broaden its field. There are now specialists in most every line. The most important, exact and pronounced specialty is that which has to do with the formation of the jaws of man. To be able to mould a deformed jaw into a perfect one is an exact science. Orthodontics is that exact science. When we realize how great is the need of normal position of the teeth, normal relation of the arches and harmony in the size of the arches, then and only then can we realize the great field of orthodontia.

The jaws at birth, unless there be congenital disturbances, are in the proper relation to the face and head and to each other. As there is nothing to interfere with the eruption of the temporary teeth, they will usually erupt in their proper position if the child is of normal health and develops normally. There are cases occasionally where there is a mesial or distal relation of the lower arch, but these cases are not frequent.

It is not possible, in my mind, to tell the cause of every case of malocclusion even though we do have a definite history, but we can systematize our knowledge in such a way that the average case will give us a clear vision of the cause.

When we speak of inherited malocclusion we think of some relative having the same class of deformity as the case under consideration. May not this be a case of the child living in the same environment as did the relative or may it not be congenital? There are able men that claim that there are no cases or inherited malocclusion. In the past few years these men have had occasion to treat and study the different forms of malocclusion to a great extent and have divided causes into either local or general. We must confess that from the standpoint of biology, embryology, anatomy and histology there is no evidence of malocclusion ever being inherited. Each individual germ-cell possesses a certain amount of chromatin that presides over inheritance and we have no evidence that malocclusion is impressed upon the chromatin of that cell. We hear such things as this child inherited the large teeth of the father and the small jaw of the mother. How can this

*Read before the Central Wisconsin Dental Society and the Oshkosh Dental Society, October 12, 1915.

be possible when the teeth and jaws both come from the brachial skeleton? The size of the teeth are determined at the time of the fertilization of the ovum and if the child leads a perfectly normal life there will be jaws large enough for the teeth.

I want to say now that at this time I do not want to declare myself for or against inherited malocclusion. There will be a time in the near future that we can positively say if there are inherited oral deformities or not, for there is so much discussion about this that there will have to be positive research.

The causes are not well defined, but there are etiological factors that we can surely say cause malocclusion. These are divided into two groups—local, and general or constitutional.

General causes are those which effect the general functions of the individual to such an extent as to interfere with the development of the teeth and the surrounding structures supporting them. They include the ailments of childhood which interfere with the development of the complete dental apparatus by producing a high temperature that acts upon the epithelial structures. Included in this group are such as measels, chicken pox and scarlet

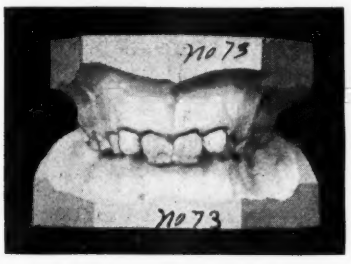

Fig. 1.—History of rickets complicated by adenoids and early extraction of temporary teeth.

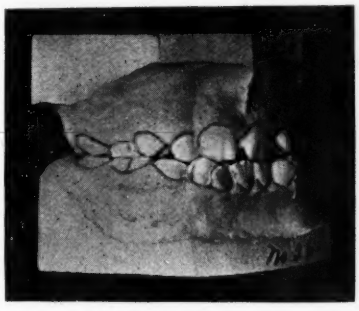

Fig. 2.—History, lack of use complicated by extraction of temporary right lateral.

fever. These effect the formation of the enamel sometimes to such an extent as to cause complete atrophy of the enamel organ, thereby producing teeth of faulty shape. We have often been told that syphilis was the cause of the so-called "Hutchinson teeth," but it has been found that there are some other diseases that also produce them, one of which is rickets.

In rickets, we find a great many cases of oral and facial deformities, in a great many different forms. Owing to the faulty bone formation, the teeth are not properly supported and the least pressure from the tongue, cheeks, or the act of mastication forces them into malalignment. (See Fig. 1.) In rickets the temporary teeth are slow to erupt and are lost early, thereby causing malocclusion, as the early loss of the temporary teeth always is an inducement to irregularities. Pathological conditions found in rickets, plus the tardy eruption of the permanent teeth, always produces some type of malocclusion.

The so-called disuse, which is not as good a name as "lack of use," which it really means, is another big factor in producing contracted arches and teeth in malposition. (See Fig. 2.) In these days of soft foods and hurried mastication, there is not enough force applied to the jaws to develop the bones

and there is a lack of lateral widening. If the bones of the jaws are not stimulated by pressure through mastication there is little bone growth. Exercise will develop nature's first intention and fulfill the laws of ancient periods. That is why there are few cases of teeth in malposition among our forefathers. They used their jaws.

Lack of lateral widening will first be noticed between the central incisors. If the lower permanent central incisors have not moved into the line of occlusion by the eighth year, for we know that they generally erupt lingual to the normal, there is a lack of development. There are several acquired factors producing malocclusion coming under the head of disuse, among which are painful mastication owing to decayed teeth, abscessed teeth, failure to contour fillings properly, and extraction of temporary teeth.

When we hear of adenoids and enlarged tonsils causing maldevelopment of the dental arch, we must think of them only as the indirect cause. The direct cause is mouth-breathing. A constant state of perverted muscular action we should remember is the cause of this class of cases. We know that when the mouth is open the tongue is in the floor of the mouth and the

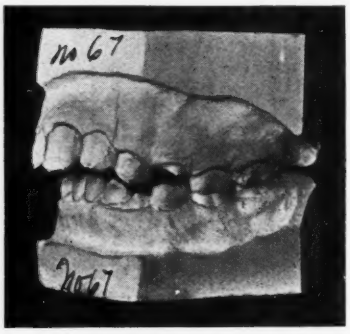

Fig. 3.—History, adenoids.

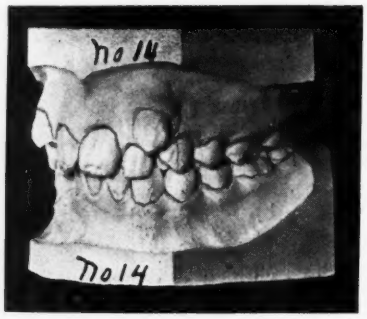

Fig. 4.—History, adenoids removed at about eight years.

muscles of the cheeks continue their pressure, though slight, upon the upper arch until, if this condition is not attended to, we have a contracted arch or probably arches. It depends upon the occlusion whether the lower arch is contracted, for the force of incline planes in contact is sufficient to reduce the size of the lower arch also. (See Fig. 3.)

There are two distinct types that have their beginning through mouth-breathing. One of these types we all are familiar with and which is very noticeable—the protruding upper anterior teeth. We call this the face of an adenoider. The vacant stare is very noticeable; drooping eye-lids and frequently hard of hearing, short upper lip, the external nares undeveloped, mandible undeveloped, and a poorly developed chin are other characteristics. The lower lip is thicker and lies back against the lower teeth and the upper portion of the lower lip exerts pressure on the lingual surfaces of the upper teeth.

In a child with nasal obstructions the atmospheric pressure, acting as a force, is absent, which is one of the main reasons the nasal cavity does not develop.

The other types that have their beginning with mouth-breathing are those that have their nasal obstructions removed at an early age but not

early enough to prevent the abnormal locking of the molars. They have made special effort to keep the lips closed, forcing the upper anterior teeth lingually, and the lower molar being one cusp distal to normal makes the space for the canine very small, consequently it has to erupt labially, lingually, or, as it often does, becomes impacted. (See Fig. 4.)

When there is an enlargement of the facial tonsil to a marked degree, we find an altogether different form of arch relation, viz., the mesial relation of the lower arch. This enlargement produces a fullness in the throat and suffocates the individual, especially when lying on the back, as at that time the enlarged membrane seems to fall back. By protruding the mandible this effect is relieved. Should this practice continue, even for a short time, during the eruption of the first permanent molars there will surely be a mal-

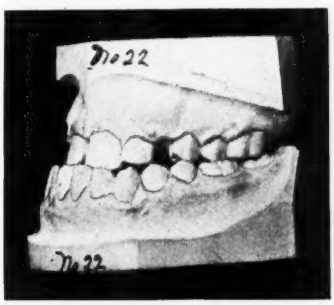

Fig. 5.—History, enlarged tonsils, abnormal frenum and lack of use.

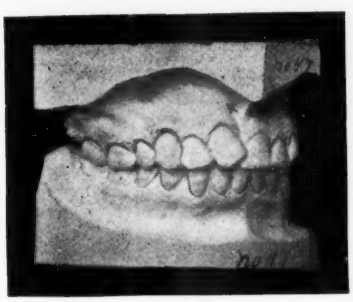

Fig. 6A.

Fig. 6B.

Fig. 6.—Supernumerary impacted tooth complicated by missing right premolar. (See X-ray, Fig. 6B.)

relation of the arches which orthodontic treatment alone can restore to normal. This condition to get positive results must be treated during the active period of growth. (See Fig. 5.)

Supernumerary teeth have their part in the development of malocclusion, but these cases are not so plentiful. We might go back to Darwin's theory as a cause of these teeth and say that we are descendants of apes and have not entirely lost the characteristics of those creatures as they have eight more teeth, premolars, than man. It depends a great deal on the position of these teeth what sort of irregularity they produce. (See Figs. 6A and 6B.)

Impacted teeth are quite numerous especially of the permanent canine. There are several conditions that can produce impacted teeth, such as the early extraction of the temporary teeth, thereby letting the already erupted

permanent teeth drift to find approximal contact. The incline planes of the canine, which it has on every side, deflect it from the normal by coming in contact with some other tooth during eruption. This I think is the main reason that we find them mostly at the lingual. If the tooth or teeth so placed (Fig. 7A) are not taken care of, there will be absorption of the lateral roots, as the canines usually are found, by the use of X-ray, to lie close to the roots of these teeth. Some advise the surgical removal of these teeth, but I favor bringing them into the line of occlusion by orthodontic treatment, because there is either a small arch, with the lateral approximately the first premolar, a space that is should occupy, or a temporary tooth that will not last forever. (See Fig. 7B.)

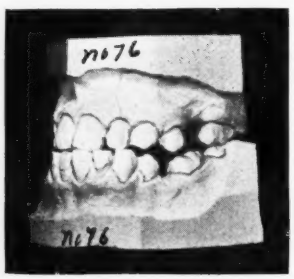

Fig. 7A.

Fig. 7B.

Fig. 7.—Impacted upper canines and lower second premolars complicated by extraction of upper left first permanent molar. (See X-ray, Figs. 7B.)

Extraction of the permanent or temporary teeth is always sure to produce oral deformities. The extraction of the permanent teeth does not do as much damage as the early loss of the deciduous teeth, but unfortunately we find cases of very great deformity of the face and oral cavity which have been produced by loss of the permanent teeth. The early loss of the deciduous teeth may be either constitutional, as when associated with rickets, or local, as when associated with extraction or decay. (See Fig. 8.) Without approximal contact, the teeth will sometimes drift for quite a distance. It would be impossible to describe the many different forms of irregularity that exist under these conditions. The early loss of the temporary canine, I think, produces about the most difficult type. Many a deciduous tooth is

extracted when there is no tooth to take its place, especially is this true with the second temporary molar. If there is any doubt as to the permanent tooth being present the X-ray is a sure method of diagnosis. I think you will agree with me that the deciduous teeth that are lost first (meaning before the permanent ones are ready to erupt) are the upper canines and second molars and the lower laterals, canines and second molars. The extraction of any of the deciduous teeth takes away that wedging force that is so necessary in the growth of the bone of the jaw.

The permanent tooth if extracted should be replaced by some sort of artificial substitute to keep the teeth on either side of the space so made, from migrating. Very often the loss of one permanent tooth will effect the whole masticating efficiency of the dental apparatus. (See Fig. 9.)

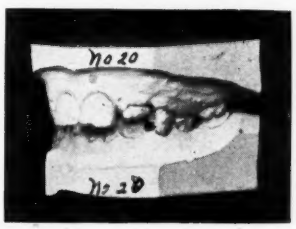

Fig. 8.—Early extraction and loss of approximal contact by decay of temporary teeth complicated by lip sucking.

Fig. 9.—Extraction of upper permanent laterals and lower left permanent canine at about twelve years.

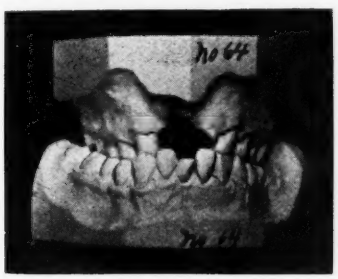

Fig. 10.—History, contracted upper arch due to fracture by accident. Upper teeth all lingual to normal.

Abnormal frenum produces a space between the centrals which usually is all the deformity produced, yet there may be other deformities from other causes. (See Fig. 5.)

The habits of childhood produce certain types of deformities. Thumb and finger sucking have long occupied a place among etiological factors, but not as much as frequently thought. There are also a few cases caused by the lip habit, tongue habit and cheek sucking habit. These all have a type of deformity peculiar to themselves. (See Fig. 8.)

Occasionally we find where accident has caused a malocclusion, all of which produce forms that are peculiar to themselves. (See Fig. 10.)

In certain cases other conditions are found that play a part in the production of oral deformities. Each case must be studied thoroughly and every effort made to find the etiological factor responsible for the deformity, also the effect these have had upon the individual.

REVIEW OF SOME STUDIES OF RACHITIC SKULLS OF MONKEYS.

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IT has long been known that many of the lower animals at variable periods after their captivity develop a softening of the osseous skeleton.

Otto, in 1814, described a softening of the bones of the skull in young dogs. Curlt, in 1838, described a similar condition present in the bones of the skulls of monkeys in captivity. The investigations of the foregoing observers were substantiated by Crisp and Marie. Percey, in 1844, reported a brown cebus which, after having been placed in captivity, developed the disease to such an extent that a general deformity resulted. As the disease progressed, various bones of the body broke spontaneously, the most pronounced fracture being of the hind legs. At this stage in the development of the disease, the animal lost all control of the broken legs, and when it moved about the cage the legs were dragged after it. At an autopsy, a careful examination of the viscera was made, and no pathological changes were noted.

Vrolik, in 1848, observed a marked thickening in a macacus nemistrimus.

Up to 1844, the condition which we now know and recognize as rickets, was not considered as rickets by the early writers, but instead, they called it hyperostosis, osteomalacia, scorbutus, etc. Huschke was the first author to associate the bony changes noted in the skulls of monkeys with rickets. His studies were carried on in the museum at Jena. One skull which especially attracted his attention was that of a young pavian, which, when measured, showed in comparison to other skulls of the same species, an increase of 14 mm. in its size. The fontanels of this animal's skull were all open, the lamina interna was partially divided. After the publication of Huschke's observations, the softening of the bones noted in monkeys was known as rickets. Schmidt, a former director of the Zoological Gardens of Berlin, was an excellent student and observer of the diseases of monkeys, and in his studies he reported a brown pavian whose legs showed a marked rachitic bending, and states that a similar process was present in a cercopithecus and also in a cebus capucinus. Schmidt did not consider the condition observed as a rachitic one, but as an osteomalacia. In 1889, Hutchinson and Sutton observed that monkeys in captivity developed deformities of their legs and heads. Hutchinson published his observations under the title of "Ostitis Deformens", while Sutton published his under the title of "Leontiasis Ossea". At a later date, Sutton published his second paper, in which he considers the malady as rickets, and he further states that the majority of the apes in the London Zoological Gardens die of this malady.

Von Hanseman, through the courtesy of Heck, Director of the Zoological Gardens of Berlin, was able to make an extensive study of the monkeys in those gardens. His principal studies were confined to young monkeys who had not shed their first teeth, and who had been in the zoological gardens for one month or more. The first symptom of the onset of the disease was that the monkeys did not climb about in their cages as readily as they did

when they were first placed in them, and further that they were more content to sit on the rests placed in the cages. This first symptom of the disease was soon followed by marked inactivity of the animal, and it seldom sprang from one place to another in the cage as it had done when first placed therein. This stage was followed by a more marked inactivity of the animal, and a little later the hind legs became affected, showing weakness to a slight degree at first, but as the disease progressed the weakness became more marked. The monkey no longer indulged in the caprices of its healthier fellows, but sat upon the floor of the cage. When the animal reached this stage in the development of the disease, it made no effort to stand on its hind legs when moving about, but instead slid about on the floor of the cage on its hind quarters. This stage was soon followed by complete loss of control of the hind legs, after which the front legs became affected, and they also became useless. The animal now became helpless and lay about on its belly in the cage. When the monkey became helpless, its fellows commenced to tease and torment until the animal, in sheer exhaustion, died. The most common complications which accompany the final stage of the disease are pneumonia, tuberculosis, and spontaneous fracture of the affected bones. In addition to the bending of the legs, the overgrowth of the bones of the skull causes a marked deformity of the face of the animal, the upper jaw becomes short and thick, and because of the excessive osseous development, the mouth of the affected animal is constantly open. In addition to the foregoing deformities, the back of a monkey affected by rickets assumes the contour of a mad cat. Careful examination of the animal after death shows that this latter deformity is not kyphosis.

An examination of the epiphysis of the affected bones shows them to be markedly swollen, and also that the ends of the ribs at the point of union with the cartilage of the sterum are also swollen. If it is the good fortune of the animal to recover from the disease, the bones again return to normal, and if by chance any of the bones are broken during the presence of the disease, they heal quite readily; but at the point at which the fracture occurs there is generally a deformity of the bone. Some of the animals which recovered from the disease lived for fifteen years afterwards.

From the foregoing observation of Von Hanseman, we learn that Sutton was not entirely correct in his report that all of the monkeys in captivity die of rickets. At the autopsy, the viscera of many of the dead monkeys presented a picture which greatly resembles tuberculosis, pneumonia, and follicular catarrh of the small intestine as in man, and also an enlargement of the spleen and nodulation of the stomach.

The periosteum of the bones of monkeys affected by rickets is softened, and, as a whole, is more markedly affected than in man. This, in many instances, is not confined to parts which show a deformity, but the entire periosteum of the bony skeleton is affected. The deformity of the head of an animal affected by this process shows more markedly than in any other part of the body, for here we observe a marked increase in the thickness of the bones, and they are very soft and porous with a marked softening of the periosteum covering them.

One of the monkeys which Von Hanseman studied had been privately owned for five years prior to its entrance to the Berlin Zoological Gardens.

This animal did not make the effort to escape which monkeys generally do after they are placed in the cage. Further observation showed that the monkey was not as active as its fellows, that its movements were sluggish, and that a considerable amount of prodding was required to make it move, once it became settled in a comfortable position. This sluggishness persisted for a short time, after which all of the symptoms of rickets commenced to manifest themselves. The snout of the animal became markedly thickened, the canine fossa was very pronounced, the central and lateral incisors showed a developing malocclusion, and the canines commenced to rotate mesially. At this stage of the disease the molars showed no change in their position, and the occlusion was normal. The long bones of the animal showed various deformities at the time of death.

Another skeleton studied by Von Hanseman was that of a cebus capucinus which had been in captivity fifteen years, three years of its captivity being spent in the Berlin Zoological Gardens. This animal, in contrast to the one just mentioned, did not show a deformity of the skull, but it did show a more marked deformity of the long bones. In addition to the deformities of the long bones, there was a marked shortening of the long bones of its fore-legs when compared to the normal length of the long bones of the same species. The spine of this animal was very markedly bent, resembling kyphosis. The upper arm on either side was markedly bent in its upper third, as were also the ulna and the radius. In addition to the bending, there was a marked thickening of the bones. Von Hanseman states that the spinal canal is also variably affected. Sutton, in his studies of the lining membrane of the spinal canal, learned that there is a variable softening of it, and he concludes that because of this process the functional nerves do not have a normal exit, and hence the animal develops a lameness which is dependent on the extent of the softening of the lining membrane. Van Hanseman does not agree with Sutton in this explanation of the lameness of the animal; on the other hand he contends that the process noted is a transverse myelitis. In all of the specimens examined Von Hanseman was unable to find a softening of the spinal canal.

We have seen from the foregoing that rickets exists in the monkey, and therefore can begin a further study of this disease and its effects on the bones of the skull, and then by analogy we can form mental impressions of this disease, when present in the human skull.

The lower jaw shows a variable separation with small points of osteophytic development. In some places the osteophytic process builds on the surface of another osteophytic process. Hence, by this process of overdevelopment, one can readily comprehend how the contour of the bone is changed. At some later period these osteophytic areas become completely calcified, and by this latter process is explained the marked thickening so often observed in the bones of the skull. The most rational explanation offered for this process is that the blood vessels are markedly dilated, and that at the same time there occurs a thickening of the periosteum; and further, a variable inflammation is present. The bone affected by this disease is very porous, and the fresh specimen has a blood-red color. A like color is observed in the bone in which the osteophytic process is present. The condition of the periosteum in man is, no doubt, the same as that observed in monkeys.

The diploe in the monkeys present the same picture as observed in man, and the dura likewise is not affected.

In many instances one notes that there is very marked softening of the occipital region of the skull which on examination resembles a craniotabes. Elsasser contends that this softening of the bone is the result of pressure from the brain when the animal (or human) affected by rickets is lying upon its back, granting, of course, that the head is resting on its occipital portion. This may be the case in the child, but it is not likely that such is the case in monkeys.

In an examination of the skull of the simia satyrus, Von Hanseman observed that there was a marked thickening of the periosteum, and that when the periosteum was removed the greater portion of the skull was soft and porous, but that occasionally a small area of calcified bone was noted. A further examination of the skull of this animal showed that the teeth were very insecure in their position, and that the distal root of the third molar was completely denuded of alveolus, as were also the roots of the second molar. The alveolus in the interproximal spaces between the teeth also showed a marked absorption. Many of the skulls which Von Hanseman examined showed a compensatory osseous development in the course of the development of rickets.

The softening of the bones is periosteal in character, and it is supposed that when fractures occur, these softened areas are the places of fracture. When infections occur, they likewise occur in these areas. This observation is very unlike that observed in healthy individuals in the process of developing bone. The early investigators held that the development of rachitic bone shows it to be an outgrowth from the outer plate of the bone, and that coincident with this process there is an absorption of the inner plate of the bone. Von Hanseman, in his investigation of this theory, came to the conclusion that the foregoing explanation was not correct. He found that the inner plate is not destroyed and that the bone again becomes firm and hard upon the physiological activity of the periosteum and the bone cells in growing animals and in man. Von Hanseman also made a careful study of the dura mater, and he reports that it is not affected like the periosteum in rickets. If, by chance the rachitic process of the skull is complicated by a pathological process, he noted that the dura mater and the diploe are affected.

A further study of the internal surface of the rachitic skulls showed that there was no rachitic softening of the dural side, but that a softening of the bone occurs from the periosteal side and that the process of softening progresses from the outside inward toward the dura. It was also shown that when there is a complete softening of the bone present, it in no instance began on the dural side, but that it is an extension inward from the process on the periosteal side. In the young skulls the bone is very porous, while in the skulls of older animals it is a sclerotic process. In many of the skulls examined, the process greatly resembles that of a hyperostosis of the inner plates. One can thus readily understand why, in the beginning of the study of the disease, the outgrowth of the bone observed by the early investigators received such names as osteosclerosis, hyperostosis, leontiasis, etc. In the deeper portions of the outbuilt bone are areas which are markedly softened. On maceration

of skulls from rachitic monkeys, some greatly resemble a wasp's nest, while others resemble a sponge in structure. Von Hanseman, in his studies, macerated the skull of a ceropithicus in water at 37 degrees centigrade for twenty-four hours, and at the end of that time he noted that the greater part of the upper jaw was lost, and that the portion which remained was composed of a few spongy bone nests. The weight of the skull in a dried state after this treatment was greatly reduced in comparison to the weight before being macerated. Another specimen examined, a papio porcarius, showed by measurement that the bone plates had a thickness of 1.8 cm., and the skull weighed 102.2 grams, while another skull studied by Von Hanseman, a papio hamadriasis, weighed 322.2 grams, and the thickness of the bone plates of the skull were 1.5 cm. From the foregoing we learn that the bone plates of the first skull were 0.33 cm. thicker than those of the second, but that the skull of the second was much heavier than the first. This difference in the weight of the two skulls is, no doubt, due to the increase of inorganic material in the second skull. If the animal with rickets does not die, the porous areas of the affected skull are soon filled with osseous material, as a result of which they become very heavy. Many times small areas are observed in which this process has not been completed, but if the animal had lived these areas would have been filled with the osseous material the same as the other areas which had been filled. In making a cut through bone affected with rickets, one notes that there are present areas which appear to be diploe. Microscopically the cut section of the bone of many skulls examined by Von Hanseman greatly resembles osteosclerosis. Von Hanseman, like Virchow, believes that it is a secondary process of hardening. Microscopically, one observes that there is not a normal lamellar system, but instead, there are concentric lamellar systems developed around the blood vessels. In this respect the disease in the monkeys resembles the pathological picture presented in man.

In other skulls studied of the papio olivaceus, papio hamadriasis, and lagothrix cana, there was a marked process of osteophytic building going on. Thus, from the foregoing, we learn that there is present an increase of the periosteum and also hyperostosis. This process was quite markedly persistent in the skull of a sclerotic hamadriasis. The marked thickening and sclerosis observed does not resemble a synostosis of the bones, and the binding together or holding together of the bones is not a locked union as is observed in normal sutures; but instead there is a partial union at one point and a complete union at another, or at no point can one discern a suture of the bones. In another specimen the bones of a rachitic skull showed a practically normal process of union. Thus one finds that even though rickets is and has been present, one will occasionally find that the disease is not constant in its markings. In other specimens examined, no union whatsoever was present, and the sutures were open. Many times the fontanels do not remain open, but closed, and here we again learn that this is not a positive symptom of the disease in monkeys. This last point, however, is a very valuable one for differentiation between monkeys and man; for in man, when rickets is present, the fontanels are always open in the young. The general picture presented in the rachitic skull is that it resembles a hyperostosis and a thickening which resembles a sclerosis. Because of the mixed

appearances of the affected bone, one cannot classify the disease as either one or the other of the foregoing conditions, nor can one classify it as an exostosis. The softening of the bones is not an exostosis, for the reason that there is an actual softening of the bones first which is accompanied by an actual process of the building of the bone rather than a process of exostosis. This is an important point to be remembered between these two processes.

Bisher does not agree with the theory of Virchow that a hyperostosis and exostosis actually exist, but that the condition observed is an osteodevelopment which occurs after rickets. Von Hanseman does not agree with either of the above authors, but believes that rickets is conducive to an exostosis; and further he believes that an exostosis can develop in man and monkeys in the absence of rickets. Von Hanseman, on further study, observed the skull of a three-year-old ursus verginianus with a marked hyperostosis which increased to such an extent that the animal was blinded by the compression of the optic nerves as the result of the increased growth of bone. An examination of the eyes showed them to be normal. The nasal passages of this animal were closed by the excessive growth of the nasal septum, and a marked thickening of the upper jaw was noted that was osseous in character. This process was very pronounced between the lateral halves of the bones. The bone overlying the two central incisors was greatly increased in amount, and was composed of soft spongy osseous material. The great increase in the size of this animal's head gave it the appearance of a monster. Sutton, in further studies on rachitic skulls, learned that the foramen is variably diminished in size. Another specimen, examined by Von Hanseman, showed a very excessive overgrowth of the upper jaw, so that the nose or snout of the animal lost its normal contour and no longer resembled the physiognomy of a monkey, but that of a man. The most pronounced instances of this deformity were noted in two apes, the one a lagothrix cana and the other a papio porcarius. An examination of these heads showed that there was an overgrowth of the periosteum, but that the dura was not affected. This observation coincides with the observations made of the heads of humans affected with rickets. On further examination it was learned that there was no thickening of the bone plates of the head on the dural side, but that thickening developed from the periosteal side.

A study of the mandibles of some of the monkeys which were affected with rickets showed a thickening of the inner and outer plates. This thickening, however, was not uniform, for some parts showed a greater thickening than others. When the rami are affected by rickets, the thickening is not as marked as is the body of the mandible. In some of the specimens, the thickening of the body was so marked that the genial tubercles were partly obliterated. The angle of the jaw is rounded and compressed, while the margin of the mandible was thickened and round. The mandible is not a compact mass of bone, but is composed of soft spongy bone which is easily bent. One can not foretell how extensive the rachitic process really is in the human, but reasoning from analogy it is safe to assume that it is likewise affected. The influence of this disease, no doubt, is marked on the position of the deciduous teeth, for as the bone is soft and spongy and increased in size, the position of the deciduous teeth is without a doubt affected. If the animal has not erupted all of its deciduous teeth, one can, with a degree

of certainty, predict that they are not likely to erupt, and if they do, they will in all likelihood be greatly deformed because of the nutritional disturbances which accompany rickets. Von Hanseman states, from his studies on the jaws of a cercocebus collaris, that the erupted teeth of these jaws showed no developmental changes, but that the unerupted teeth, after their eruption, fall an easy prey to caries; this can be explained by the fact that the teeth which erupt after the development of the disease are deficient in the compactness of the enamel and also in the inorganic substances which enter into its composition. Having learned that these marked changes are present in deciduous teeth in the process of development after rickets is developed, it is only rational to suppose that we can thus account for the many poorly developed permanent teeth, and many times the absence of permanent teeth. By the increase in the size of the maxillae and mandibles, brought about by rickets, the deciduous teeth are placed in many different positions, and further, as we well know, the roots of the deciduous teeth act as guides for the developing permanent teeth, therefore it is easy to understand that if these teeth are not in a normal relation that the permanent teeth likewise will not be. The alveolus in which the teeth are supported being a soft spongy mass is another factor of importance, when we consider the malposition of the teeth. And further, in lieu of the irregularity of the teeth, either deciduous or permanent, and the soft spongy alveolus; when they are brought into occlusion the bony support is not sufficient to maintain the position of the teeth, and they are forced into malocclusion, and if any of the teeth are rotated or tipped at one angle or another, this will, when brought into occlusion, cause a springing of the weak bony support, which in time gives away and the tooth takes on a greater angle and malocclusion goes from bad to worse. This process may be confined to a few or all of the teeth, and by this process the normal function of the teeth, namely the incisors for cutting, the canines for tearing, and the molars for grinding, is likewise impaired. In addition to the inconvenience of the malocclusion of the teeth, the animal can not masticate its food as it should, because of their insecureness; and further, when masticating its food, the teeth are very painful when brought into occlusion. Because of these many difficulties the animal refuses food, which at this time is indeed very necessary for its bodily needs in addition to the salts which the food contains and can be added thereto, which will supply it with the salts needed for the repair and the building of its osseous development.

Rickets is not a disease common to wild monkeys in their native state, but it is one which they soon contract when placed in captivity. At once we ask the question; what is the cause responsible for the development of the disease in these animals? Is it that these animals, in their wild state, live on certain foods rich in bone building salts, or is it necessary that they have a large range over which to roam? And further, is freedom and plenty of fresh air necessary to the health of the monkey? Is the air, the confinement, and small range of action which they are allowed in captivity responsible for rickets, or is the food which they receive deficient in the necessary salts for their osseous development; or are their hygienic surroundings in captivity the cause of rickets? No doubt improper food, bad air, lack of sunshine, and limited range of action are all factors which are at the bottom

of the trouble. Once the vitality of the animal is lowered, it is more of less susceptible to the development of rickets, and after the rickets is once developed, the vital forces of the animal are lowered to a greater degree than before, and the animal is more likely to contract tuberculosis; and further, the animal will, with very little exposure, contract pneumonia. These two diseases are the most common complications which monkeys can contract when afflicted with rickets.

Let us now summarize the findings learned by the study of rickets from the skulls of monkeys.

1. That the thickening of the skull is primarily confined between the periosteum and the bone, and that the thickening is never from the inside out. That process seldom, if ever, reaches the point which resembles craniostosis.

2. The skulls of young monkeys show a marked thickening in the fresh state, and on cut section show a marked thickening, and the cut surface is of a rich blood-red color. This latter fact shows that the bones are very highly vascularized, and on maceration they are shown to be very porous.

3. An examination of the skulls of older monkeys shows that the thickening noted is sclerotic in type, and that the spongyness observed in the skulls of the younger animals is absent.

4. It is learned that if the skulls of the younger animals are macerated they fall to pieces.

5. Skulls which present the appearance of an exostosis are not from animals suffering from rickets and therefore should not be classified as such.

Having described the onset, the invasion, and the course of development of the deformities and complications of rickets, let us now study some photographs which show very excellently the presence of the disease in the skulls of monkeys.

The following pictures were selected from Von Hanseman's "Rachitis des Schädels."

Fig. 1—Papio Cynocephalus Leukopheus.

An examination of the anterior portion of the superior maxillae shows an area of marked porosity of the bones which stands out in bold contrast to the area not affected. At the upper portion of the diseased area, we note that there are present many foramina in the substance of the porous bone. It is very queer indeed that the area lying between the canines should be the only area attacked by the disease. On the left side, one notes that there is a marked bulging over the root of the central incisor at its upper portion.

Fig 2.—Papio Olivaceus.

An examination of this picture of the skull shows at a glance the extent of the rachitic process. The line of union between the two halves of the maxillae are widely separated, and the nasal septum is gone. The line of union between the premaxilla and the maxilla proper stands out in bold contrast on the left side. On further examination, we observe that there is a marked thickening of the maxilla and also of the mandible, and in addition to this thickening the bones are very porous. A marked absorption of the

bone covering the central and lateral incisors in the upper and the lower jaws is noted. On further examination we observe that crowns of the left superior central and lateral incisors are very poorly formed. On the labial surface of the right central incisor on its mesial half, one notes an area of

Fig. 1.

Fig. 2.

poorly developed tooth structure. Taking the skull of this animal as a whole one observes at a glance that the bones of the face are more markedly affected than any of the other bones.

Fig. 3—Lower jaw of same animal.

An examination of the lower jaw skull shows that it is greatly increased in thickness, and that the anterior portion shows a distinct porosity of its substance. The margins of the jaw are rounded, and the genial tubercles are obliterated.

Fig. 4—Macacus Nemistrimus.

The picture of the skull of this animal shows very excellently what a very destructive process rickets is when it reaches its maximum. The lateral incisors on either side are lost, and the central incisors are in good approximation, yet there is no union between the two halves of the alveolus. The teeth, it will be noted, are tilted at many different angles, and the only teeth

Fig. 3.

Fig. 4.

in occlusion are the molars. The teeth in the lower jaw all tip toward the mesial, and a variable amount of destruction of the alveolus around them is noted. The entire skull of this animal presents a marked porosity of the bones, a variable thickness of which is noted. The margins of the lower jaws are rounded, and it is greatly increased in all of its dimensions.

Fig. 5—Papio Porcarius.

This is the mandible of a papio porcarius, which was described by B. Sutton in his work on rickets. This specimen presents a very interesting

study in that it shows a very marked thickening of the mandible in mass, and further shows the teeth are not in any definite position, some of them being in approximate contact, while others are out of their normal alignment. The genial tubercles are not visible and the thickening in this region is very marked. Note also the upper surface of the mandible, which is supporting the teeth; it is not inclined as in the normal, but offers a broad base.

One should carefully examine these pictures and form a mental impression of them, so that when confronted with a case of typical rickets one is fitted to compare, by analogy, the process in the human. Fortunately for

Fig. 5.

man, the disease is never allowed to progress to the extent noted in the apes, but it is possible that many times when the process is not as far advanced as shown by the pictures, it has advanced far enough in the child to bring about a condition of the bone which will be a very important factor etiologically responsible for many of the malocclusions noted by orthodontists. This latter statement is the reason for the appearance of this paper which the author hopes will be of some service to those who are practicing this specialty.

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THE HISTORY OF ORTHODONTIA.

(*Continued from page* 571)

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NEW YORK CITY.

CLAUDIUS Galenus or Galen.—Whatever progress was made in dental art seems to have been lost after the fall of the Roman Empire, as the only writer of later times who devoted much attention and time to the teeth and their diseases was Galen. After Hippocrates, Galen the founder of experimental medicine, was undoubtedly the ablest and perhaps the most renowned physician of his age. Born at Pergamos, a city in Asia Minor, in the year 131 of the present era, he died in 201. Lived most of his life in Rome, intimate with the emperors Lucius Verus, Marcus Aurelius, Commodus and Septimius Servus; was an extraordinarily voluminous writer on medicine and philosophy; lectured publicly on anatomy, practicing as a physician. At the age of seventeen, he began the study of medicine, but his activity as a student did not really begin until after the death of his father in 150 A.D., under the guidance of physicians of repute of his own country. He began to travel in foreign lands, in order to profit by the teachings of the most eminent men in his profession. "He studied under the rival sectarians of Dogmatists, Empirics, Methodists, Pneumatists and Eclectics, in the school of Alexandria. At the time of his appearance the schools of medicine were a prey to the most pernicious dissentions, the partisians of the school of Erasistratus, of Hippocrates and of the Empirical, Methodical, and Electic sects, divided in their opinions, agreed but in one point, that of converting medicine into a tissue of frivolous subtleties and useless discussions. In the midst of this disorder Galen appeared, and returned to the safer road of patient thinking and accurate observation, which so much distinguished the Hippocratic School."

He devoted himself to the investigation of organic nature, and diligently pursued inquiries relative to the structure of animal bodies.

For thirteen centuries his system reigned supreme in Europe, Asia, and Africa. Like Hippocrates, he was greatly in advance of his time, regarding anatomy as the basis of medicine. Practically all his knowledge was gained from the dissection of lower animals. "The great duty of the physician he

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described to be that of maintaining the different parts of the human body in their healthy condition, and of re-establishing their healthy functions when diseased."

He studied with the greatest care the bones, muscles, heart, blood vessels, brain, nerves, and in fact all parts of the human organism.

His osteology was fairly perfect. He distinguished and named the bones and sutures of the cranium, nearly as they are known at the present time.

Fig. 1.—Saint Appolonia, Patron Saint of Dentistry, was born in Alexandria, and lived during the third century. In the year 300 A.D. she was canonized by the Church of Rome, and the ninth of February has been observed by the Church of Rome in her commemoration.

"As a Christian she was tortured by having her teeth broken and extracted, after which she was burnt at the stake. When under torture she is said to have prayed that those who remembered the day of her martyrdom, and in their prayers realized the pain she suffered, might never have toothache or headache."

"He gave the first clear account of the vertebræ, their division into cervical dorsal and lumbar, distinguishing these latter from the sacrum and coccyx." He also described the ribs, sternum, and pelvis, as well as the bones, and their articulations. The alimentary canal he subdivided into the following parts: gula, esophagus, stomachus, jejunum, cecum, colon, and rectum."

The most interesting of his writings are those which pertain to the heart and vessels proceeding therefrom. The first in this line is that which later led to the discovery of the circulation of the blood. "He recognized seven

pair of nerves originating from the brain; and describes the nerves of the spine as passing out in pairs one on each side." He also gave the names to the corpus collosum, the septum lucidum, and corpora quadrigemina. The pathology of Galen for a period of sixteen hundred years was almost implicitly followed.

He gave a better description of the teeth than any one who wrote prior to his time, claiming that they are formed during gestation, but remain inclosed in the alveoli until the period of birth, and indicated exactly the number of incisors, canine and molar teeth, and of the various functions performed by each. The incisors and canines have but one root, the upper

Fig. 2.—Galen. (131 A. D.–201 A. D.)

molars generally three, and the lower mostly two. He designated the canines as eye teeth, owing to their receiving branches of the trigeminus or the fifth pair of nerves, which also go to the eye. He wrote a long chapter on the functions, forms and evolution of the teeth, which he believed to be true bone. "Why have we exactly thirty-two teeth fixed, and sixteen to a row in each jaw, the front ones called incisors, sharp and large, capable of cutting in biting? Next come the canines, large at the base and sharp at the top, capable of crushing a substance too hard to be cut by the incisors. Then follow the maxillarus, also called molars, uneven, large, hard and long, to grind the food cut by the incisors and broken up by the canines."

"The teeth," he says, "by effects of mastication, are continually worn down, but nutrition repairs the losses, therefore preserve the same size. But when a tooth, from want of its antagonist, is consumed but little or not at all by mastication, we see that it grows gradually longer, for the very reason that under such conditions the increase due to nutrition is not counteracted by a corresponding waste." When one or more teeth, in conse-

quence of a trauma, or from any other cause, became loose and projected above the level of the others, he removed the part by the means of a small file."

Adamantus of Alexandria, philosopher and physician, who probably lived toward the close of the third or the beginning of the fourth century, draws attention to the influence of the canine teeth on the shape of the face and draws deductions from their relative positions as to the character of the individual. "His writings are in two parts, the first on the expression of the eye, the second on physiognomy in general. He professes to have learned much from the Egyptians, and tells us that nature speaks in the forehead and face and in the silence of the mouth."[1]

Oribasius, another great physician and scholar, lived at the end of the fourth century (316-403).

At the request of the Emperor Julian, whose physician and friend he was, he made extracts of all the works left by the ancients, arranging them in a methodical order, and dividing them into seventy-two books, of which we

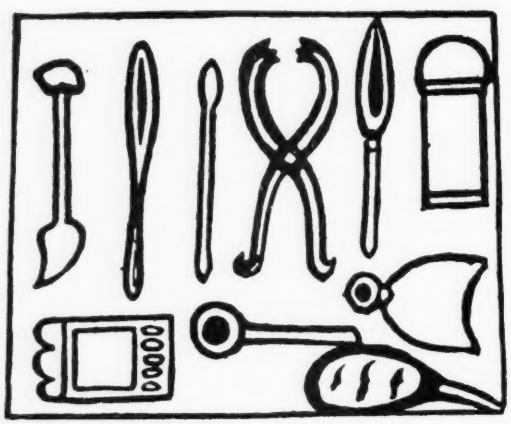

Fig. 3.—From a sculptured marble tablet, now at Lateran Museum, Rome, showing instruments.

at present possess seventeen. Later he extracted from this collection the most important parts and compiled them in a book, which he named, "A Synopsis."

We owe to him a description of the method of preparing medicines, the first description of the membrana tympani, and of the salivary glands. In his works are found many points pertaining to dentition and diseases of the teeth, but little that was new or important.

Aetius of Amida, 527-565, a celebrated Greek physician, and author of numerous works pertaining to medicine, lived the latter part of the fifth century. Like all practitioners of his time, he studied at the famous school of Alexandria, later establishing himself in Constantinople, where he became physician to the Imperial Court.

Aetius pursued the same steps as Oribasius, collecting everything he considered of worth from existing writings on medicine, which he then published in sixteen volumes under the title of "*Tetrabiblos*." This collection contains two points worthy of notice; the use of the cautery, and the medical efficacy of the magnet. He also introduced much of what is known as Egyptian pharmacy, being particularly fond of external applications. His

1.—Encyclopaedia Britannica, 11th Edit., vol. XIX, p. 4.

account of Galen's principles of materia medica is particularly comprehensive, and shows that the Greeks were well provided with vegetable medicines.

In regard to dental diseases he mentions the cause of toothache to be known only to God. He taught that the mucous membrane of the gums, tongue and mouth is provided with nerves from a portion of the third pair of

Fig. 4.—Saint Appolonia, Patron Saint of Dentistry.
(From an ivory carved figure of the XVI Century.)

cerebral nerves, and that the teeth, too, by a small hole existing at the end of every root, receive tiny ramifications of sensitive nerves, having the same origin. The author claims that the teeth continue to grow to old age by the deposition of nerve fluid, but at a certain period in life, this process of nutrition ceases, and the teeth become thin and loose, and fall out.

During dentition, he advises that children should not be given hard

objects to chew, as the gums may thereby become hardened and render the cutting of the teeth very difficult.

Paulus Aegineta (625-690), the last classical Greek author, flourished about the beginning of the seventh century. Little is known of his early life, but it is thought he studied at Alexandria, previous to the capture of that city, and the destruction of its famous library.

He was the first physician who appeared to have become famous for his attention to female diseases and obstetrics. Like his predecessors, Oribasius and Aetius, he was more of a compiler than an original writer, col-

Fig. 5.—Saint Helena (ca. A.D. 640), who was invoked for heart and dental troubles. (From an early woodcut.)

lecting the medical knowledge, which had been accumulated by the Greeks and Romans and transcribing it into seven books. In medicine he does not merit much regard, but his surgical researches and discourses were new and interesting.

He established a very clear distinction between epulis and parulis. His ideas in regard to the extraction of teeth are similar to those of Celsus, first detaching the gum all around the tooth as far as the alveolar border, then the tooth is seized with the forceps, shaken loose and drawn out; this should, however, be done only as a last resort.

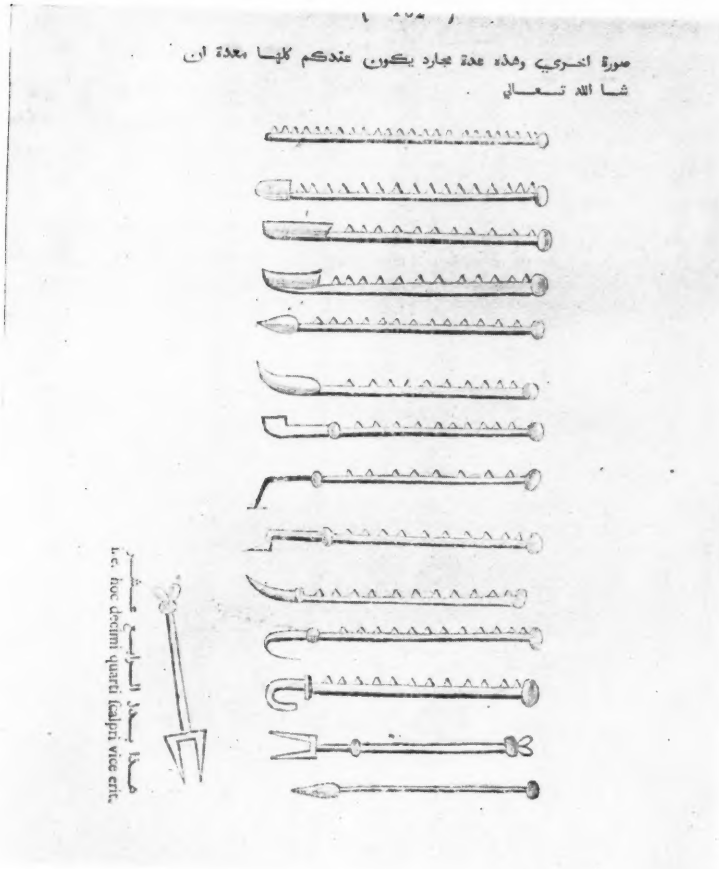

Fig. 6—Set of fifteen dental scrapers. (Albucasis.)

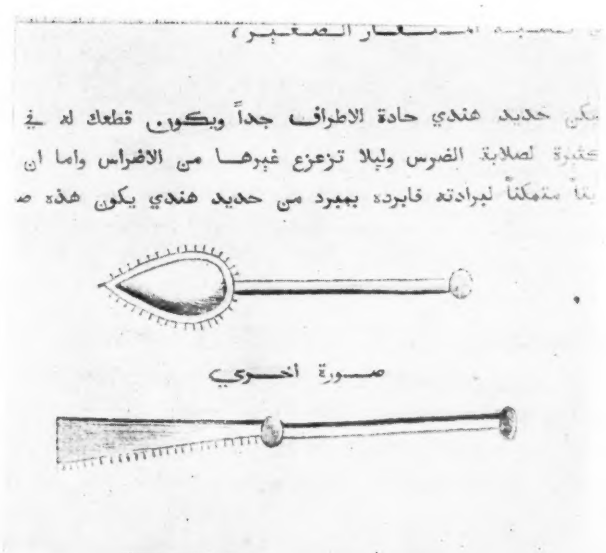

Fig. 7.—Dental saws. (Albucasis.)

He paid considerable attention to the regularity of the teeth; "when supernumerary teeth cause an irregularity of the dental arches, they may be corrected by resection of such teeth, or by extraction. In case one projects above the level of the others, the part protruding should be removed by means of a file."[2]

He advises that hard substances should never be broken with the teeth and after every meal the teeth should be carefully cleansed. During dentition infants should not be given food that required mastication.

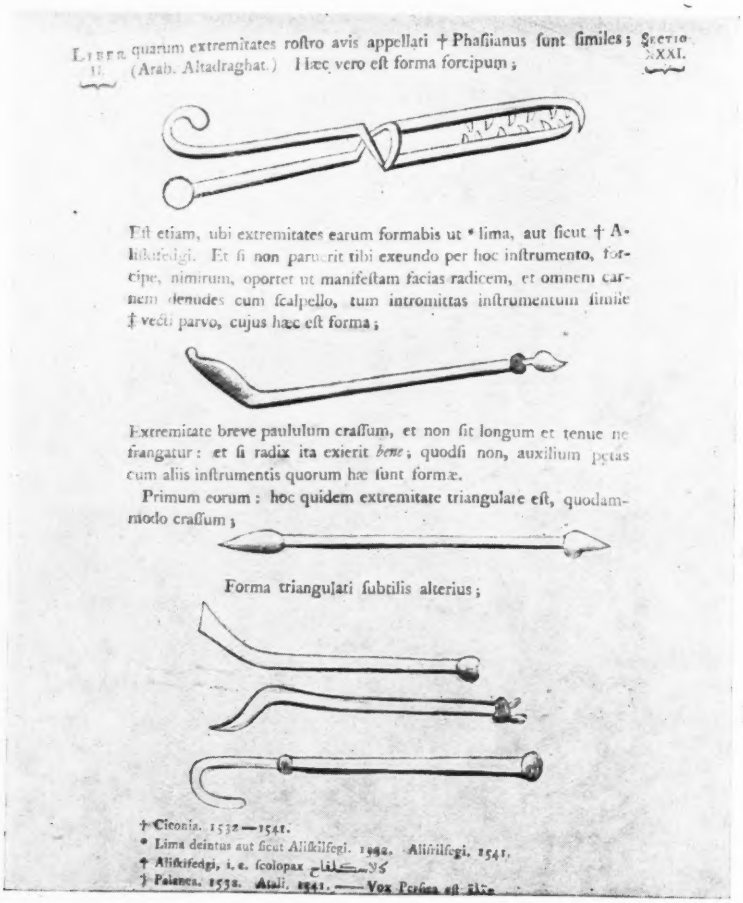
quarum extremitates roſtro avis appellati † Phaſianus ſunt ſimiles; SECTIO XXI.
(Arab. Altadraghat.) Hæc vero eſt forma forcipum;
A.
Eſt etiam, ubi extremitates earum formabis ut * lima, aut ſicut † Alikikifedgi. Et ſi non parueris tibi exeundo per hoc inſtrumento, forcipe, nimirum, oportet ut manifeſtam facias radicem, et omnem carnem denudes cum ſcalpello, tum intromittas inſtrumentum ſimile ‡ vecti parvo, cujus hæc eſt forma;
B.
Extremitate breve paululum craſſum, et non ſit longum et tenue ne frangatur: et ſi radix ita exierit *bene*; quodſi non, auxilium petas cum aliis inſtrumentis quorum hæ ſunt formæ.
Primum eorum: hoc quidem extremitate triangulare eſt, quodammodo craſſum;
C.
Forma triangulati ſubtilis alterius;
D.
† Ciconia. 1532—1541.
* Lima deintus aut ſicut Alikilfegi. 1942. Alikilfegi. 1541.
† Alikifedgi, i. e. ſcolopax
‡ Paiuca. 1532. Atali. 1541. — Vox Perſica eſt

Fig. 8.—(A) Forceps for extracting roots when the tooth breaks in the extraction. (Albucasis.)
(B) Elevator to be used when the extraction of a root, by means of the root forceps, proves impossible. (Albucasis.)
(C and D) Elevators. (Albucasis.)

The Arabians.

When art, literature and science waned in the West, they again kindled into new life in the East. "For about five centuries the Arabs were the conservators of learning and to their taste and care we owe the preservation of many of the masterpieces of Greek philosophy. Colleges were founded and splendidly endowed; magnificent libraries collected at an almost incredible expenditure."

Their success was perhaps greatest in astronomy and medicine, though

2. Pauli Aeginetai de re medica, lib. VI, Cap. XXVIII.

in the latter, as the Koran absolutely prohibits the dissection of human bodies, all anatomical research was impossible. For this reason the Arabs contributed but little towards anatomy, their greatest progress being in chemistry and pharmacology. Being adverse to bloody operations they were reluctant to extract teeth, and employed all possible ways to obviate this.

Rhazes, (860-932). The earliest of the great Arabian physicians was Mohammed-Ebn-Secharjan-Abou-Behr-Arrasi, so called among his people, but commonly known in medical literature under the name of Rhazes. In early life he applied himself to music; but tiring of this he began to study medicine traveling in Syria, Egypt, and Spain for the purpose of acquiring information. "He was a better anatomist than any of the other Saracens, but his obser-

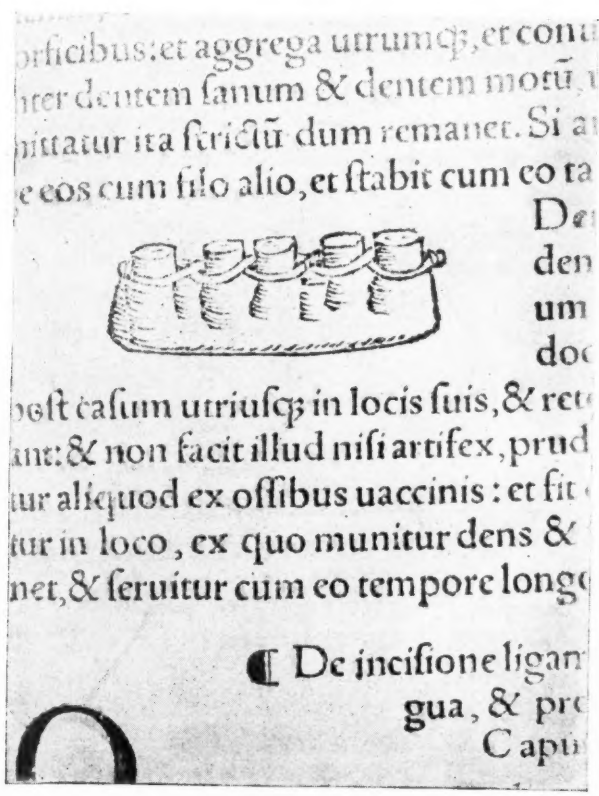
orficibus:et aggrega utrumq; ,et conu
nter dentem ſanum & dentem motũ,
nittatur ita ſtrictũ dum remanet. Si a
e eos cum filo alio, et ſtabit cum eo ta
De
den
um
doc
poſt caſum utriuſq; in locis ſuis, & ret
ant: & non facit illud niſi artifex, prud
tur aliquod ex oſſibus uaccinis: et fit
tur in loco, ex quo munitur dens &
net, & ſeruitur cum eo tempore longo
¶ De inciſione ligam
gua, & pre
Capi

Fig. 9.—Method of ligating teeth.

vations were confined almost exclusively to the organ of voice (larynx). He first described the pneumogastric nerve and distinguished the superior laryngeal from the inferior or recurrent.

He was a voluminous writer, upward of two hundred of his books have been preserved. His best known work is that on smallpox and measles. Among the list of new remedies used by him, we find the sulphates of copper and iron, borax, arsenic, etc., all of which are in use today.

As in the case of all the Arabian physicians, he devoted considerable care and study to the teeth, having recourse to extraction as a last resource, when all other means at cure proved useless. He considered caries of the teeth the same as that of the bones. He made an attempt to stop the decay

of the teeth by means of a "cement" composed of mastic and alum. "To strengthen lossened teeth," he recommended astringent mouth washes and dentifrice powders. Rhazes relates of an interesting case of regeneration of a whole lower jaw; he, however, observes that the newly formed osseous mass was less hard than the original bone.[3]

Ali-Ben-Abbas or *Haly-Ben-Abbas*, a Persian by birth, wrote a compendium of medicine under the title of "Almaleci," a lengthy treatise on practical and theoretical medicine. He was a strong advocate of the use of mineral waters in the cure of diseases.

In cases where supernumerary teeth caused a deformity in the dental arch, he removes these by means of a forceps in the shape of a beak.

Avicenna (980-1036), an abridgment of Al-Hussian-Abou-Ali-Ben-Abdallah-Ebn-Sina-Al-Schenikh-Al-Reis; prince of physicians of whom one historian wrote: "It would be difficult to find any one after Aristotle and Galen who reigned for a longer period and more despotically over the empire of science." He was the last of the Arabian authors who wrote on medicine, his successors being born in Spain, where the Saracens were then having sway. Although the doctrines of Avicenna were followed for over five hundred years, little that he did was original. From the great amount of material furnished by his predecessors it was not difficult for him to write his great work, "*Canunfi el Thebb*," or "*Cannon of Medicine.*" "This elaborate treatise became the standard authority of the school, and enjoyed its influence unimpaired until the revival of the letters at the close of the fifteenth century, when the original Greek authors came in vogue again." In its pages the author treats, with a good deal of independent reflection and practical knowledge of the laws of dietetics, the preservation of health in different climates, the action of the gastric juice, strongly advising the use of mineral waters and the advantage of studying diseases in the hospitals.

He studied minutely the anatomy and physiology of the teeth, but contributes very little to that already given by Galen. In regard to the different causes of odontalgia, he mentions also the little worm, which he supposed gnawed its way into the tooth. He also made use of arsenic. "In order to have loosened teeth become firm again, one must avoid using same in mastication, not to touch them with the fingers or tongue, and not to speak more than absolutely necessary, but must make use of astringent remedies."

On the subject of prophylaxis and preservation of the teeth, he spends considerable time and attaches thereto great importance. He warns against dentifrices containing hard and course particles, as such are liable to injure the tooth surface. He also warns mothers against the custom of allowing infants to chew hard substances to facilitate the cutting of teeth; instead, he recommends that the gums be rubbed with the fingers.

As in the case of all his predecessors, Avicenna is of the opinion that the extraction of a firm tooth must be avoided as much as possible, fearing that it might injure the jaw, or even sight. By shaking the tooth, complete cessation of pain will take place in certain cases. If this fails to stop the pain, the tooth should be drilled, emptied and filled. When the dental arch is irregular or contains supernumeraries, he follows the same course as his pre-

3. Rasis opera, Venetiis, 1508.

decessor, Ali Abbas, either removing same with a forceps in the shape of a beak, or by use of the file.

He, like Galen, believed that the teeth continue to grow, owing to the absence of antagonists, thereby causing them to elongate. When this takes place, in order to correct it, he files the tooth until it has reached the proper length, holding the tooth firmly between the fingers or with pliers he designed for the purpose.

Albucasis or Abulcases Buchasis, Kahlaf-Ebn-Abbas-Alul-Kasem (1050-1122). Perhaps the most interesting of Arabian physicians and the greatest of surgeons, was Albucasis. His work "*De Chirurgia*", a celebrated book on operations and surgery, contains descriptions and illustrations of the surgical instruments then in use, and the great importance of an accurate knowledge of surgery. It is divided into three sections. Book one, deals with diseases that can be treated by cauterization; Book two, all operations that can be performed by surgery, such as cutting, perforation or extracting; Book three, of fractures and luxations. In this work he first describes the manner of removing stones from the bladder. Albucasis, perhaps more than any of the other Arabian physicians, paid greater attention to the care and treatment of the teeth. In general he follows the treatment of his predecessors, but is perhaps the first author who has taken into consideration the formation of dental tartar. He recommended a thorough cleansing of the teeth with a set of fifteen scrapers, devised by him for this purpose.

He, like all the great Arabian physicians, considered it wrong to extract a tooth, recognizing the importance of retaining same and the poor result obtained by use of artificial teeth. He was the first who clearly taught that teeth might be replaced either by other human or by artificial teeth, made out of the bone of the ox. When he did extract, he used the same careful means as his predecessors, but with improved forceps. If these failed, he then resorted to the elevator.

"When, in consequence of a blow or fall, one or more teeth have become loose so that the patient cannot bite his food with them, if the use of styptic remedies has been found of no use, it will be necessary to bind and make such teeth firm by a gold or silver wire. Gold is to be preferred as being unalterable, whilst silver in a few days turns green. Having chosen, therefore, a suitable gold wire of perfectly uniform consistency, it must be passed at its middle part between two firm teeth, that is between the two nearest on one side to the loosened tooth or teeth; then, by binding tightly around the sound tooth and each of the loosened teeth the two lengths of the wire and crossing them in the dental interstices so as to form a kind of net work, the sound and firm tooth of the opposite side will be reached, and this too must be wound around in a mesh, as it were, of the said network. Then turning back, the same operation must be repeated, but inversely, until the point of departure is reached. All this must be done with much skill, so as to render the loose teeth completely immovable. When the wire is tied, this must be done near the dental roots, so that the knot may not get untied; then with a pair of scissors the remaining part must be cut off and its two ends joined and twisted with a pair of pincers, hiding them between the sound tooth and the neighboring loose one. Such a ligature should remain in place during a whole

life time; and if it should become undone or the wire should break, it will be necessary to renew the operation."[4]

"Sometimes, when one or two teeth have fallen out, they are replaced in the sockets, bound in the aforesaid manner and they will remain there. The operation must be carried out with great delicacy and ability, by skillful hands."

As may be seen from the above quotation, in the days of Albucasis replanting was already performed, although it is probable that the ligature was then left permanently.

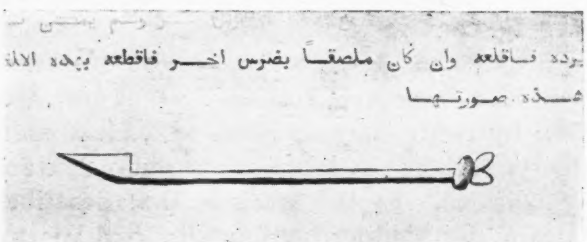

Fig. 10.—Small axe for resecting irregularly placed teeth. (Albucasis.) The first instrument so far known for correcting irregularly placed teeth.

"The vacancy left by fallen teeth can be filled up with artificial ones, made of ox bone, they also being fixed in the manner above described; they will be found not only of advantage from the esthetic but also from the functional point of view."

"When a tooth is irregularly placed, or projects above the level of the others,[5] a deformity ensues which is particularly displeasing in women. The way of correcting this varies according to the nature of the case. It consists sometimes in the simple extraction of the misplaced tooth. But when there exists an intimate (osseous) union of the irregular tooth with another one, it is necessary to operate for the resection of the former with an instrument the shape of a small axe."

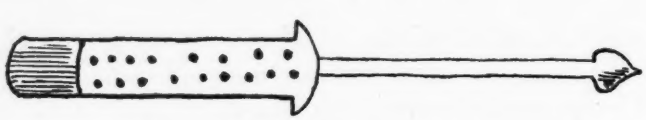

Fig. 11.—A dental file. (Albucasis.)

"The operation must be performed in many days, not only on account of the hardness of the tooth, but also in order not to shake any of the neighboring teeth. In other cases, the deformity, consisting in one tooth projecting above the level of the others, may be corrected with a saw. The instrument must be made entirely of Indian iron, and the operation like the preceding one, is to be carried out in several days, that the fall of the tooth may not be provoked by excessive shaking. The file (Fig. 11), too, must be used to destroy edges and points of broken teeth, that they may not injure the tongue, or give any trouble in speaking."

4. Albucasis. Lib. II, Cap. XXXII.
5. Albucasis. Lib. II, Cap. XXXII.

We thus find that these, as well as the other Arabian writers, *Mesue the Younger*, and Avenzoar, have derived most of their knowledge from the older Greek physicians. They based their treatment from them, and elaborated upon their already complicated prescriptions. It is evident that since the fall of the Roman Empire, little advance was made in the science of the dental art, that the profession confined itself to the surgical aspect, and lost the beautiful and mechanical side of the Etruscan and early Romans.

Annual Clinic, Chicago Dental Society.

The annual clinic of the Chicago Dental Society bids fair to surpass in efficiency and enthusiasm the splendid clinics in the past. A notable list of clinicians have been selected and arrangements are under way for a clinic which will place before guests and members the best in modern scientific dentistry. The evening meeting on Friday, January 28, will mark an epoch in dentistry. The banquet will be held on Saturday evening, January 29th.

Reservations for rooms at the La Salle Hotel, Chicago, may be made any time. Banquet tickets may be had by addressing Dr. S. W. Fahrney, 25 E. Washington St., Chicago. The official program will be issued January 1. Exhibitors desiring space may communicate with Dr. L. Strong, 30 N. Michigan Avenue., Chicago.

Percy B. D. Idler, *Secretary*,
30 N. Michigan Ave., Chicago.

FREDERICK B. MOOREHEAD,
President

Care of the Mouth.

PERHAPS no part of the body is so often neglected as the mouth; especially is this noticeable in the case of children. A mother, who will religiously bathe her child and keep its body sweet and clean, will often fail to clean its mouth. A new-born infant should have its mouth washed after each feeding; a soft cloth wet in a weak solution of boracic acid should be used for this purpose. If this were always done we should rarely find a case of infantile sore mouth.

After the teeth come and the mouth is large enough, a small soft brush should be used; the teeth and mouth should be thoroughly cleansed at least twice daily.

In illness, where sordes and mucus accumulate rapidly, and where the tongue is parched and stiff, attention is needed every hour; the mouth should be kept moist, and the same treatment carried out through the night as through the day. Boracic solution, listerine, lemon juice, glycerine, and distilled water are all refreshing and soften the tissues; where the lips are chapped or fissures appear, a lubricant of cold cream or sterilized vaseline should be applied. Where the gums are spongy or soft and bleed easily a few drops of tincture of myrrh added to pure water will help to harden them. Small squares of old linen or soft gauze should be used instead of a brush where one is ill or weak. These should immediately be burned after use.

Every part of the mouth should be cleansed; behind the wisdom teeth, the roof of the mouth, and under the tongue; lemon juice will remove the fur from a thickly coated tongue. Where the teeth are sensitive, the water used should be slightly warm,—*Pediatrics*.

CURRENT ORTHODONTIC LITERATURE

EDITED BY H. C. POLLOCK, D.D.S.

Habit and Malocclusion.*

AN article on habit and malocclusion from the pen of *George Van Ness Dearborn, M.D.*, of Cambridge, Mass., Phychologist and Physiologist to the Forsyth Dental Infirmary for Children, Boston, and published in the October 30th issue of the *Medical Record*, has recently come to our notice. Because of the great value of this subject to the orthodontist, we have deemed it advisable to publish Doctor Dearborn's paper in full:

* * * *

My remarks will concern certain features of the theory of habit so far as related to special forms of muscular behavior. The precise name of the discussion is "Habit and Malocclusion." It is a great satisfaction to me to have a chance to talk to you. I talk four days a week to over five hundred students, male and female, and they have me so thoroughly in the habit of talking that it has become a pleasure! My scientific specialty being other than dentistry, it rightly may be assumed that my remarks will concern habits mostly, rather than malocclusion. However, unless there be a preclusion, near the conclusion of my talk there will be some little inclusion of occlusion.

Habituation is a well-nigh universal process in our experience. The over-eating habit, for example, just exemplified. Machines made of steel, of brass and of wood are said by some to acquire habits just as organisms do. Shoes, coats, neck-scarfs, have habits. The rain running down a new mountain side soon acquires definite habits which we call brooks. You have all experienced, probably, habits in dental engines, not, however, worse or better than your own habits. Every machine, in short almost everything we are familiar with, has habits. Habit is surely a universal process in matter, in all material mechanisms, whether non-living or self-repairing, *i. e.* living. But observe that in organisms its basis is in the *matter*, not in the mind, so far as we can see. A "mental habit" at present means practically nothing. Compare, for example, if you wish to understand how habit in living "mechanism" is determined by the material aspect and not by the mental, the shadows on the moving-picture screen. It is impossible to think a series of successive mere shadows as having any habits; they are obviously put there by material mechanisms from outside themselves; it is as impossible to think of habit in such a series itself as it is to think of the events as the respective causes of each other. If we are to find anything, then, in the way of causation of habit in this pure series of events or processes, we have to turn back to the mechanism that continues it, namely, the film apparatus. It is more or less the same with mental process, viewed as phenomena. It is at present unbelievable that habit in an organism is a mental process. It is matter, protoplasm, that has habit. The mind doubtless exists in some mode separate

*Remarks made (for the most part) before the Eastern Association of the Graduates of the Angle School of Orthodontia at Hotel Puritan, Boston, 27 March, 1915.

from the body, but if so we know nothing of it as yet, and, therefore, habit (to conclude this matter) appears to me to be a matter of mechanism and not of the soul at all.

However that may be, a polemic question certainly, habit in our organisms and personalities is practically universal. The only exception of which I am aware is the lack of a habit not to form habits! It has been said that habit is "second nature," but William James, the great dead psychologist, suggests that habit is nature itself. In order to realize how universal the process is in organisms, it is necessary for a moment to point out the nature of the only sort of process that is *not* habitual, which is, namely, true or real voluntary movement. Suppose, for example, that your revered and philosophic grandmother, having much money to spend, had said that she would give you a thousand dollars if you, without training, would engrave *without any slip or mistake whatever* a complex, delicate, and artistic monogram on the rounded belly of a small cream jug. Those of you who have tried to do such a thing realize the difficulty of accomplishing it, the difficulty, clearly, being not one of doing it, in a sense, but one of *preventing* yourself from doing something you did not wish to do. In short, it is the *inhibitory* process, which is the really voluntary movement. I take it that this is the only occurrence in all the body's behavior that is not somewhat habitual, and that everything else you could possibly think of has some degree or other of habituation in it. It is in all cases relatively easy and in some extremely easy to do things "never done before" because they all have some degree of habituation, for this, in short, is the universal principle of neuro-musculo-glandular action. So you have in the organism all possible grades of habituation, from the strictly new voluntary movement to the action of the heart or the beating of any other of the rhythmic organs. But inhibition is theoretically the sole unhabituated and represents the free will of the human as opposed to the vegetative.

Next we will take up briefly the biologic function of habit, and this, as you all know, is economy; first, of time, second, of energy, and third, economy of variation. Habit serves, at least in the way of economy, those three things; it saves time, saves unnecessary expenditure of energy, and makes everything more constant. Habits then are theoretically sure to be "bad" as well as "good", and some of them indeed are bad and surely some are good. Some suspect that bad habits are formed more easily than good habits, for fish, as well as souls, bite averagely well on the Sabbath day. The basis of the fact that it is easy to form habits, especially bad habits, in the long run is always *satisfaction* in some way or in some other. We always get satisfaction, of course, out of the repetition of an act which causes any degree of pleasure, but also out of pain, ideational satisfactions, or out of any other form of will-fulfillment whatever, we may get at times true satisfaction. You all know, for example, that when one has a sore tooth there is a kind of satisfaction to be obtained from pressing that tooth, making it hurt; if you have a hang-nail there is a certain sort of satisfaction in causing pain from it. Thus we cannot say that the formation of habit depends only on true pleasure, because there may be no pleasure concerned. The same applies to self-denial, and to other forms of satisfaction-getting, which appear to be so painful. Even the martyr being burned at the stake can be psychologically said

to get some compensatory satisfaction out of what is usually considered an unalloyedly agonizing process.

Often the satisfaction concerned is subtle and hard to appreciate, and yet it is none the less effective. In other words, it may be purely physiological, kinesthetic, or tactile. A neuromuscular habit may be purely kinesthetic, or it may be a matter of satisfaction derived from the pure sensory experience of touching things, perhaps the result of an instinct of curiosity of an exploratory nature. The dynamic basis of the satisfaction, as of joy, is the kinesthesia of normal bodily activity becoming more and more inhibitory (human) as the child's personality unrolls. A child may do things which promptly lead to fixed habits with any one of these three physiological suggestions, so to say, behind the movements. Action itself is seen to be satisfaction in this way, and muscle-action, at first made by chance, so to say (really developmental practice), may become quickly and fixedly habitual by repetition long before any habit is realized.

It has been said that the bodily mechanical movements of respiration, the ordinary process of inspiration, and to a less extent of expiration, give rise on the average to more satisfaction during a life time than any other thing—the kinesthetic experience of taking air into the lungs. I merely wish to suggest here, for future reference, that this universally known process of inspiration pneumatically considered is one especially of suction.

Cosmetic values, of course, are very greatly disturbed by some of the muscular habits that children get into. If we compare the women with the children who sit before us in the trolley cars, for example, in this respect, we can see the effects ahead as well as the causes behind. You can readily point out certain children who, when they become adults, will have badly deformed and perhaps unworthy faces simply because they have been allowed to form the habit of holding their mouths, and so on, in various positions which are going to become fixed. How many good men are needlessly scared away from matrimony by this contrast between the middle-aged women whom they sometimes see and these women's children. Physical education should care for these conditions. As I pointed out some years ago, in the child's early years it should be one function of the physical educator, in the playgrounds and in the schools, to tell children what some of them are doing in this particular respect, and to point out some of the deformities which they quite needlessly are bringing on themselves by a lack of appreciation of what is happening through, in turn, a lack of proper guidance. This certainly should be one of the recognized and practised functions of physical instructors on the play-grounds and generally in the schools. Physical education, I regret to say, is certainly not making many important applications in these broad outside ways.

Human personality has two phases; one is actuating, impulsive, "vegetative," and the other is inhibitory, restraining, or controlling, and comes from the cortex of the brain. Childhood inherently lacks this latter inhibitory phase of behavior, and its necessary development can occur only through the endless action of every possible group and combination of muscles, nerves and glands. The nerve-centers have to be impressed year after year with what James called the motor ideas of every possible action that the organism can make. Biologically, then, childhood is inherently the time of impression

of the nerve-centers (especially the cortex of the brain and spinal gray matter) with all possible movements. Childhood is the period, too, of growth and development by way of practice and habituation. By these and such means Nature incites evoiution, especially by the dim satisfaction of new kinesthetic expressions.

This kinesthetic matter is, of course, by no means a new matter, but only in recent years has it been appreciated as the fundamental sense of the animal, especially of the human animal. Curiously enough, there is something about the sense of vision that entirely drowns out "the muscle-joint sense," but this is only a matter of consciousness, for the kinesthesia is there all the time and in absolute control of the muscles. We do not control the muscles by means of vision; our eyes only stop and start each gross movement about where it should be stopped or started, for it is the kinesthetic sense that has the effective control in all ways over the muscles. This sense is dim but it is continual, and when the eyes are closed so that we can get consciousness behind the subconscious, so to say, it can be developed almost to any extent. Helen Keller, for example, in her book, "The World I Live In," has a whole chapter devoted to telling how much benefit she gets out of the kinesthetic sense and her other remaining senses.

At this late day in the psychology of behavior, we do not need to spend much time in the discussion of kinesthesia. It is a sense often subconscious which originates in the joints, muscles, bones, tendons, and skin; all of these parts, at least, are continually sending strains or impulses into the cortex of the brain. Only so has the brain complete control of the organism, just as it would be impossible for the switchmen in the tower down at the South Station to guide the numerous trains out and in that station unless he knew continually where each train was, its speed, and so on. That corresponds to the kinesthetic impulses from all parts of the body, giving information as to the exact posture and location of the various limbs and the degree of contraction of all the body's muscles.

The kinesthetic sense, therefore, is there at the same time in complete control and under complete control, and the voluntary muscles are actuated consciously by the child because of the satisfaction it affords, if for no more explicit reason. Sometimes the need of relief from kiensthetic strain (allied to the "fidgets" coming from too much caffein or nicotin) is the cause of apparently random and seemingly unnecessary muscular movements. On a Sunday afternoon when we have not had our usual muscular activity we get "fidgety," *i. e.* the muscles get uneasy as the result of their demand for adequate activity, and this need shows itself sometimes as positive unpleasantness. Of course the child has this need even more distinct than has the adult, and it urges him on continually to instinctive movements of many kinds; yawning is a good illustration of a reflex endeavor to relieve this hyperkinesthetic strain.

Physiologically we may think of a motor habit (and probably all habits) as a set of kinesthetic impulses or strains, passing from the parts most concerned into the great cortex. When these strains have continued relatively long without much variation, in some way as yet wholly indefinable, they impress the central nervous system, probably the extremely sensitive and delicate neurones of the cortex in particular, and tend *pro tanta* to dominate

behavior. It is worth noting (and so far as I know, it has not been noted adequately heretofore) that it is not that the formation of a motor habit is a pleasant process or one that gives obvious distinct satisfaction, but, on the other hand, that opposition to the habit gives distinct unpleasantness, often of an acute kind. How extremely unpleasant, for example, it is not to frighten away a fly lit on the tip of one's nose. Here is inhibitory kinesthesia hard to ignore! It would be more accurately scientific to say that the formation gives pleasantness which is, however, largely or wholly subconscious, while opposition to the habitual kinesthetic set causes conscious unpleasantness. A theoretic pessimist might argue pessimism from this: The formation of habits gives us no pleasure, but to break them is pain. "Facile est descensus Averni, sed——," etc. Many habits, of course, have extraneous pleasure connected with their formation, but intrinsically the process seems regularly to be a subconscious one. As I have elsewhere shown, the actuating phase of kinesthesia is subconscious. On the other hand, the inhibitory kinesthetic strains or impluses are conscious, and when violently opposed may be intensely unpleasant. When the case is one of breaking a habit the unpleasantness may be so great that in practice it dominates the behavior at the time, and oftentimes of course subconsciously, if not deliberately in consciousness, influences the mind of the individual strongly enough to become a permanent motive, preventing the breaking of the habit. Here, then, we see the pure science of the principle, which amounts to a rule of practice, for the overcoming of bad motor habits, especially in older children, to which we shall recur later on: *Do not attempt* to break a habit in a bold and direct way; always try to be rid of it by replacing it with another habit quite as persuasive physiologically and mentally, and not injurious. In this way the individual is given whatever of satisfaction or of pleasantness (not to say, sometimes, actual pleasure) accompanies the formation of a habit while, on the other hand, the inhibitory unpleasant kinesthesia is kept at a minimum, the contest being thus a purely neural and physiologic battle, little concerned with the conscious will of the individual, and thus economical.

So much for a few obvious points in the physiology and psychology underlying habit-formation and habit-breaking in general.

We are going to discuss, of course, only certain arbitrary types of habits. In practice, that is in reality, the "types" are indefiniably confused and usually far more complex than may be described here. The essence of human personality is its uniqueness, and the chief reason for our scientific interest in behavior lies in this continual uniqueness of the individual, a law unto himself and not to be discussed in detail under any circumstances.

I have tried to suggest that the reason for some habits is the kinesthetic satisfaction, continual, however slight, obtained from normal muscular actions. So far now as malocclusion is concerned, more or less arbitrarily we may consider four groups of kinesthetic habits especially, which lead to deformities of the mouth and of the dentition. In the first class we have the group we may characterize as sucking and biting movements, which involve the sucking of the thumb and fingers, fist, either lip, the tongue, or the clothing. Some of the worst cases of paradontic deformity comes from the rather common habit of biting the clothing; boys especially get in the habit when young of biting the clothes and tugging on them. Perhaps more practically

important than this, because commoner, is the use of the so-called "pacifiers," which really should be called something else, even defacifiers. A second group of actions is the biting habits, biting either lip, the tongue, or hands. Biting is a well-defined instinctive movement in most young mammals. Third, a group which requires less effort than the other two, namely, mouth-breathing; one of the commonest, I take it, of the causes of malocclusion. It appears to be always forced by a respiratory obstruction, for no one, as far as I have observed, breathes through the mouth purely from physiologic choice. The passage of air through the nose is normally, at least, as easy as it is through the mouth, so that, as I have just said, no one with entirely unobstructed posterior nares breathes through the mouth. The fourth class of paradontic habits includes a very large number of arbitrary actions, including those of the busy hands in relation to the mouth, all sorts of tractions, distentions, etc., habits of many kinds that young children and sometimes older children get into, of handling their mouths in many various ways. I do not need to do more than cite the numerous other causes of malocclusion with which you are familiar, but there are at least thirty-five conditions which have been mentioned by witnesses as causes of this kind of deformity. Rickets is one, and osteomalacia, and tuberculosis, syphilis, scarlatina, measles; pathological injuries of various kinds coming from these organic disasters. Then there is the group of popular acquired diseases such as adenois, enlarged tonsils, chronic rhinitis, and deviated septum. Then there is a class of congenital deformities: cleft palate, harelip, supernumerary teeth, infranumerary teeth, hypertrophied tongue (such as we see in cretinism), atrophied tongue, abnormal frenum, and other forms of maldevelopment. Early loss of the deciduous teeth, early loss of the permanent teeth, and late development of the permanent teeth, complete what I think, is a fairly complete list of paradontic occasions or causes to be found in the literature of malocclusion.

Of all these habitual occasions of malocclusion I have no doubt that sucking, the first one mentioned, is of most theoretical interest; first, because it is the most common, and second, because it is most widely involved with the depths of human nature. Sucking and biting, I do not need to suggest, may be seen well in most all young brute animals and may be seen particularly well in pups, in many respects like children. The sexual relations of sucking have been much discussed of late. The great Freud has made some revolutionary and sensational suggestions in regard to it, and one in particular, that this is one of Nature's means of bridging the sexual instinct from one generation to the next; he holds the opinion that the sucking of anything affords sexual satisfaction, more or less. I think it is generally admitted now by most neurologists that Freud's opinions regarding sexual matters, of which this is an example, are in places exaggerated. To the maternal suckee, so to say, often there is some or even great satisfaction, but it is hard to see that there is much satisfaction to the sucker, unless the process produces something worth while, as, for example, milk or tobacco smoke! However, in what way the young infant can get into the habit of sucking the thumb, as very many infants do, except on the basis of kinesthetic satisfaction, I am unable to understand unless indeed it be true, as Freud claims, that there really is in it a dim, subconscious sexual satisfaction. But Freud has certainly

exaggerated the universality of sexual effectiveness in childhood, whether this be true of sexuality in adult life or not. It certainly is not *necessary*, as we have seen, to bring in sexuality to account for the widespread satisfaction of sucking and biting. Of course a man sucking a cigar has nothing whatever suggesting sexual reference, and the erethistic young man, if anyone, would have it. In children who are sexually precocious (from a deficiency of product of the pineal gland or deficiency of the product of the pituitary body?) and in highly stimulated, unrested children, sucking expressions, it may be, are actually carried over from the mother's breast and nipple to their own potential sexual feelings, but not normally, to any effective degree, I am sure. The widespread muscular (kinesthetic) satisfaction of sucking seems adequate then to explain its great popularity at all ages, but this doubtless merges in the abnormally erethistic and sexually precocious into a true sexual satisfaction, especially, perhaps, in boys. Ellis and Moll explain these relations in an adequate degree.

A well-known New York writer on orthodontia (whose name has escaped me) has offered as an explanation of thumb-sucking that the movement of the tip of the tongue in the process stimulates the chorda-tympani nerve and thence, through the pneumogastric's cardiac branch, increases the heart's action, resulting in increased blood supply to the brain, thereby increasing the circulation of the blood to the brain and inducing a sensation of satisfaction to the child. He illustrates this by the experiment of drinking a glass of water: if the water be swallowed in one gulp it produces only a slight increase of the pulse, but if it is slowly sipped the pulse is greatly augmented. As a physiological problem this, like a million others yet unsolved, is interesting, very, but cerebral congestion does not seem regularly to enhance euphoria, and besides it is such a long way around. It is almost as far-fetched as are some of Dr. Kirk's explanations of caries.

Whatever may be the cause of this habit (and that is a matter of academic discussion of purely theoretic interest), sucking and biting, we may conclude, are almost an innate impulse in humans as in brutes and are continued from infancy on, and becomes continuous on the basis of kinesthetic satisfaction when no other satisfaction helps. This is, as near as I can make out, the philosophy of sucking. The precise mechanics of the malocclusional deformity itself I need not discuss, because you know and understand it better than I do.

But three basal principles need to be recalled for the understanding of the often shocking effects of sucking the objects we have mentioned above and others during the first eight years of life; mere mention and not elaboration of these conditions is necessary. The first principle to be kept in mind is the great plasticity of the jaws, especially in babies. This is something I do not need to suggest any further to experienced gentlemen of your profession; but, curiously enough, sudents do not understand it, but they think of bone as something inherently hard, and more or less unplastic and fixed; but, of course, quite the contrary is true. The bones are extremely plastic, collodial in nature, and subject to almost any amount of deformity from long-continued impacts and strains. As an example to illustrate this, you sometimes may see a delicate green herb pushing its way through an asphalt pavement. The sprig may be so frail that it could be easily broken

with the finger, but it may push its way through a concrete pavement if the light conditions are right, by its low but continuous pressure on what is really a fluid medium. So with the jaws.

The second principle is the vigor and power of the respiratory and inspiratory movements, even in babies. If you wish an example of this, note the enormous cries of some minute and very young infants. It seems sometimes as if the cry were inversely in proportion to the size of the baby, and we sometimes are tempted to ask where they can possibly keep all that sound. Of course lung power is one of the most conspicuous things in the infant, and it has to be exercised in all kinds of ways, and here much muscle is involved.

The third consideration necessary to account for deformity is that long periods of continual pressure are involved, and the frequent repetition of the acts, as in the case of the sucking process. "Pacifiers," bad as they are, are not so bad in some respects as certain other means used by some thoughtless or vicious nurses for the same purpose, but occasionally the results are certainly far more disastrous in infancy. Biting the tongue, either lip, or the hands are conditions in part like those of sucking, but in part also the deformity in this case comes from unilateral continual pressure of one kind or another. Mouth-breathing (due to nasal or pharyngeal obstruction and made worse by tonsilar hypertrophy) is now not so common as formerly, before it was customary to keep adenoids out of the pharynx.

A fourth and last principle underlying paradontia includes the fact of arbitrary postures of the mouth and of the hands (such as the common dragging on the lower jaw), which are innumerable and undescribed and do not need to be further discussed. These represent habits theoretically as "pure" as any we could find, because we know that there is always at least a dim satisfaction coming from such muscular actions. These habits often start by chance, but are continued by this complex and over-mastering power of habituation, and soon become fixed just as firmly as the shape of an old deformed bone, or any other part of the organism as it grows and hardens.

Modern medicine is inherently and even more *prophylactic;* it is the *duty* of the dentist, the nursery maid, the physical educator, and the parent to *prevent the formation* of malocclusional habits. To this end the surest road in the long run, it seems to me, is vigorous biological normality, busy normality, I have called it. Try to make the child normal by natural hygienic means, and keep him usefully busy with natural out-of-door muscular distractions, for this kind of fatigue leads to much sleep, sound and deep, that may be called out-of-door sleep, whether indoors or out. Anything which tends to nourish the nerve-centers will tend to lessen all these tendencies toward habitual exaggeration of any one movement or kind of movement. The old verse of our dear old grandmothers, "And Satan will find mischief still for idle hands to do," is as true of babies as of older folks, and as true of lips and tongues and diaphragms and pterygoids as it is of the hands.

Modern systems of elementary education, those, for example, of Seguin, Fröbel, Montessori, Witte, Sidis, Stoner, Berle, and others, plus adequate playground systems, are doing much and are going to do much more toward developing this *busy normality* in the child. I have great respect and hopefulness for the great new system of playground education, municipal playgrounds conducted by trained experts; there is no assignable limit for the good

that playgrounds so conducted can do for children, especially in the cities. The system teaches them perhaps, for the first time, self-respect, shows them their capabilities that often would be developed in no other way. Above all, there is in the system no end of opportunity for instruction of the most advanced, most useful, and yet of the simplest kind. One of my pet hobbies is that many useful, and indeed vastly important things, which children are perfectly competent to receive greatly to their future benefit are kept away from them unjustly on the mistaken supposition that their minds are not far enough advanced to receive them. The young child of average intelligence, you may be certain, can be told many things of the most fundamental importance to their complex human lives, provided the teller knows how to do it. The impression on the subconscious mind made early in such a way may be effective throughout the life of the individual; the wisdom of life especially. What a shameful waste not to inform the child how to live, so that the crises of life, especially the emotional life, may be anticipated to some extent and sad experientia be not their only teacher!

Every intelligent child would be interested, for example, in the theory of habit; it is a matter of universal interest. If you explain to the child of average intelligence, even if he forgets in half an hour, the universality and the force of the principle of habituation, the subconscious impression made upon him will serve as a more or less unconscious rule of behavior whether he thinks of it consciously or not. This is one of the points I have in mind in speaking of the intelligent education of these patients. *Explaining* things to them—is the simple enough principle of modern psycho-therapeutics—full explanation and, to some extent, sanction of the habit. A child should not be punished or abused because he has a habit, but he must be led to *understand* the human nature of it and must be able to work out his own gradual cure. No other method is scientific, no easier way is sane or safe to the delicate personality of the young child, as we shall explain more fully shortly. For the general practitioner of the dental or other specialty of medicine, serving an office practice, this makes, in slang terms, a hard proposition. Such habits are more readily prevented than safely checked.

You cannot do much in practice unless it is in your own household, or unless you can deeply convince the parents of the essential importance of rightly controlling the habit, and obtain their full and active co-operation. In many cases at least, however, it is certain that if you start far enough back, by giving a course of out-of-door hygiene, getting them to go "back to the farm" for several months, six or so, and so fundamentally to equalize and invigorate the nervous system, thus making it so active and vigorous that this particular neuro-muscular action will be practically swamped out, you may get results. I certainly would not try to "break" a habit as such; but it may be safely and surely, most often, bent and persuaded out of its wrong growth.

The educational system, it seems to me, is *inherently defective*, in that professionally it is not based on a modern knowledge of child-life nor on the nature of the neuro-muscular mechanism. One thing in particular that we need to get out of our teachers' consciousness, is that children are "little men and women." They are, of course, just as different from men and women almost as can be, and different in the most fundamental respects. One of the chief practical difficulties in a general reform of this matter is clearly

there are far too many children to the teacher. The public has not realized yet what a good *financial* investment education is, and the taxpayers do not spend one-third as much as they should on it; they should spend four times as much as they do now, and have classes of fifteen pupils instead of from thirty to sixty, and then have the teachers properly "fitted;" professional teachers instead of girls waiting for husbands to appear at papa's front door. All the intensive modes of education mentioned are making a start in the right direction, but see what a long road this is!

The breaking of a well-fixed psychomotor habit (as has been anticipated) is wholly, for the most part, unjustifiable. A habit is not like a femur bone which may be forcibly broken and in time made to grow again straight, but, on the other hand, habit is a part of the child's organism, part of his brain action and his muscle action, ingrained in every portion of the mind and body. Too much shock to such mechanism when young deranges it and may set up very serious undercurrents in the nervous system. As you are doubtless aware, from 60 to 70 per cent at least of chorea cases are known to start in some sort of nervous shock, usually fright, and it is obvious that an acute form of shock might come from the strict, absolute insistence that a child should not continue certain deeply ingrained habits. It is not safe to break, in that literal sense, those neuro-muscular habits; too much shock in such a mechanism deranges it; one stops any child-activity at one's peril, unless it be done along natural methods.

The theoretic cure for a bad habit is a threefold process of (1) normalizing, (2) displacement (substitution), plus (3) enlightenment, the purpose being displacement. The normal way of breaking a habit, the safe way, is to displace it with something else. The neuro-muscular mechanism is far too subtle and sensitive a thing, and these involuntary habits involve too much of a strain, to make it safe to insist that it be broken off short, so to speak. Enlightenment is the crying need of the times, in matters of diet, sex, and how to live in general, and education so far has neglected them. I think the average normal child can be more or less controlled by way of his own interest; and, as I have already said, I believe that the average child even as young as five or six years, can be guided wisely if properly approached along the lines of psychotherapeutics, careful, elaborate explanation adapted to his years, pointing out the really fundamental things. I think a child under such instruction, when it is expedient, can be impressed, or at least his subconscious mind can be impressed, so that it would be effective in many of these habit conditions. But one must start with a normal, that is an outdoor, nervous system and musculature.

"Back to the farm!" is one of the most prominent "slogans" of the day. To my mind one of the greatest problems of our crowded civilization is how to get people, when they have children to raise, to go back to the farm, out into the country where there is absolute necessity of building up a neuro-muscular-glandular system which will not allow itself to be beguiled into one-sidedness, into bad habits unworthy the independence of human womanhood and manhood.

Out-of-door exercise and plenty of sleep—that is the dual but shortest road to a strong nervous system. Then to live in some place or in some way so that these are amply available, I do not know any other certain way; in

fact I would suggest in every case of bad paradontic or other bad habit that we should urge on the parents the absolute necessity of the victim getting a long and real vacation in the real country. I believe that ordinarily that will have more immediate benefit than anything else they could do, and be wholly safe and hygienic, and as speedy, too, in its action as the conditions of organic life allow.

A change of location and of surroundings assists in breaking up habits in so far as the changes invigorate the organism. When you travel in Europe, hoping to get away from your worries, you hardly succeed in leaving them behind, but in so far as travel or change invigorates, as it often does, I should say that it would lessen all abnormal functional conditions, these malocclusional habits among the rest.

Unless you have had much personal experience and unless you have thought about these habits as found in even the average child, you are not apt to realize how very firmly fixed they become. The most trivial habit soon becomes implanted so that it is a *part of the organism* even in normal individuals, and where there is any lack of inhibitory control, in a child, notably, who is slightly defective, it will become in the most literal and most obvious sense a part of the organism. This is a physiological process, the means to economy taken by the nervous system in the youthful individual. There is a very elaborate inhibitory mechanism in the individual after adolescence, throughout the upper part of the cortex of the brain, if not in the cord and stem, and that is the normal road by which to go after these habits rather than any means which would involve breaking them off short. Restraint and guidance from the neopallium, the upper layers of the cortex cerebri, inhibition through guidance, rather than trauma leading to something akin to paralysis! It may be a long-long way to this particular Tipperary, this education as to how to live, but it is the road that we all desire to see worn hard and smooth at once by the world's ever-hastening feet. The really *right* road, the ultimate golden street of all, is Prevention Way, narrow but straight, leading directly to heaven of Normal Humanity, victim only of its own deliberate faults.

Post-Graduate School of Orthodontia.

BY the opening of a Post-Graduate School of Orthodontia, the Forsyth Dental Infirmary for Children is fulfilling one more of its functions as conceived in its original plans, and one which was characterized by President Emeritus Charles W. Eliot, in his address at the dedication exercises, as one of its most important influential duties, the education of the profession and the public.

While the school is not the first to be established in this important field of dentistry, it is the first to adopt a full academic year of instruction. The curriculum is comprehensive and includes not only the technical dental subjects, but also all of the allied medical branches that have a bearing on the development of the child. The unsurpassed clinical facilities of the institution, which are already demonstrated, will provide the student ample opportunity to acquire the practical experience necessary. Emphasis will be laid on preventive orthodontia. The faculty includes not only local men prominent in their branches but also a large number of specialists from the East and Middle West.—*Dental Review.*

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EDITORIALS

The Question of Commissions or Fee Splitting.

SEVERAL years ago the American Society of Orthodontists adopted a resolution against the practice of orthodontists paying commissions to general practitioners of dentistry who sent them patients. In other words, the resolution was intended to prohibit what is commonly called "fee splitting" in the medical profession. At the time this resolution was adopted it was known to be a fact that certain men practicing orthodontia had built up their practices by paying commissions to, or dividing their fees with, the general practitioners for referring patients to them. Several members of the American Society of Orthodontists considered fee splitting as unethical, and about that time the medical profession also began taking action in their societies against the habit of "fee splitting" as had been followed by some practitioners of medicine in certain sections, and especially by the surgeons. The effect of the adoption of this resolution was that some men discontinued paying commissions, while others refused to discontinue, the latter plainly stating that they would continue to pay commissions, justifying their positions for various reasons, and resigned from the American society. It might have been imagined that this action would be the end of the question. As the society had voted against the practice referred to it was thought that those who remained would discontinue paying commissions. There was,

however, another element that entered into the question which was beyond the control of the American Society of Orthodontists, and that was the dental profession. Owing to the activity of the orthodontists, certain dental societies adopted resolutions of similar import against the division of fees when referring patients. Following this matter, we find conditions which were beyond the control of the American society, beyond the control of the dental profession, and beyond the control of all dental societies—namely, there were certain men in the dental profession who refused to send patients to orthodontists, men who refused to refer patients to specialists, unless they received a certain percentage of the fee, with the result that these men would not refer cases unless they were paid a commission. It might be said, "if there were such men in the profession, we should pay no attention to them and let them go their way;" but if such a plan were followed, it would result in a number of patients not receiving service at all, and therefore the innocent patients would be the ones to suffer.

We are of the opinion that the commission question is far from settled, because of the large number of editorials and the large amount of space that have been devoted to this question in medical journals in the past few months. A number of medical societies have adopted resolutions against the practice of paying commissions, or "fee splitting," and various state legislatures have passed laws, some of which are very stringent, concerning the division of fees by physicians. These conditions convince us that the dental profession is not alone at fault in paying commissions.

We are willing to admit that there are two sides to this question, each side possessing some elements of right. Let us review the subject as it has appeared in the medical journals, and note the action that has been taken by medical societies.

In 1912, according to the *Texas State Journal of Medicine*, the Texas State Medical Society, after some discussion of the question of fee splitting, adopted an amendment as follows:

"Any physician or surgeon shall be deemed guilty of fee splitting who shall give or receive, or arrange to give or receive, a commission, or divide, or agree to divide, a fee for medical or surgical treatment, unless the patient, or his or her next friend, is fully informed of the transaction."

The journal quotes the principle of ethics, which have been laid down for the American Medical Association, as follows:

"*Section* 3, *Article* 6. "It is detrimental to the public good and degrading to the profession, and therefore unprofessional, to give or receive a commission. It is also unprofessional to divide a fee for medical advice or surgical treatment unless the patient, or his next friend, is fully informed as to the terms of the transaction. The patient should be made to realize that the proper fee should be paid to the physician for the services he rendered, determining surgical and medical treatment suited to the condition, and in advising concerning those qualified to render any special service that may be required by the patient."

From these two quotations it would seem that the principal objection to fee splitting is that the arrangement is made without the knowledge of the patient. If the custom of division of fees is proper from a business and moral standpoint, there can be no good reason why the dentist could not say to the patient, "Now, I am going to send you to some one to have your teeth regulated, and I will get 20 per cent of what you pay the man to regulate the teeth." One can imagine the effect such a statement would have on the

average patient. Recently we had a man approach us in regard to the division of fees, and we said, "Yes, we will give you 20 per cent of the fee if you are willing that the patient shall know that you are getting it." Immediately he replied, "No, that will not do. I do not want the patient to know that I am getting anything." In other words, by the man's own remark, he was afraid to have the patient know he was getting 20 per cent of the fee that was to be paid. There was evidently something not exactly right in connection with the transaction. Governed by the principle of ethics of the American Medical Association, that "the patient should be made to realize that a proper fee should be paid the physician for the services he rendered in determining the surgical or medical treatment suited to the condition, and in advising concerning those best qualified to render any special services that may be required by the patient," there is no question that a dentist who refers a patient to an orthodontist should make a charge to the patient for that reference. In other words, the dentist is entitled to some compensation for the time he takes in talking to the patient and in advising him in regard to the services he needs. The proper course would be for the dentist to render a bill to the patient. But the difficulty at the present time is that the public is not educated sufficiently to be willing to pay a general practitioner of dentistry a fee unless some material, probably gold, is used in the teeth that can be seen. In other words, the public is in the habit of paying for dental work and not for professional advice. It will take some time before the general public will be educated to the point of paying the general practitioner of dentistry a fee for professional service rendered when referring them to some specialist. One reason why the public objects to paying for professional advice is that it has been paying the dentist fees in the past for doing operative dental work, and it contends that it is entitled to free advice. This, of course, is not right, but the best method of handling those unsatisfactory conditions will have to be determined.

It is well known that in many instances we cannot do exactly what we desire, but are compelled to do what circumstances make necessary. For this reason some men advocate that, because the general practitioner cannot collect his fees for "professional services" in referring the patient to an orthodontist by sending the bill to the patient, it should be arranged by the orthodontist, charging the patient for those services and turning the amount over to the dentist. There is some ground for the argument, and probably will for a certain time, that this would be the best way to treat an unpleasant condition. It would not, however, be the proper way.

There is no question that the general practitioner of dentistry devotes some of his time to educating his patients to have orthodontia services performed, and that he should be entitled to some compensation. It would be more honorable than fee splitting if the patient would pay the dentist directly for professional services by having the amount for such services added to the patient's bill for other dental work, as has been suggested, and collecting directly from the patient, even if the patient did not know that he was paying for such professional advice. In other words, under the head of "professional services" add the amount for professional advice to the operative work which the dentist performed and for which the patient is willing to pay. It might be said that this also would not be honorable, but it certainly would

be better than to expect the orthodontist to collect the dentist's fee under the head of "orthodontic services" and turn the amount over to the general practitioner, as the patient would then at least know who was getting his money.

Several states in the United States and several countries have passed laws to regulate the question of fee splitting. New Zealand has long had a law forbidding the practice, and at the present time there is on the statute books of the state of Texas a law which forbids any person to practice medicine, or the art of healing the sick or the afflicted, with or without the use of medicine, "who employs or agrees to employ, or pay or promise to pay," any person, firm, association, partnership, or corporation for soliciting, securing, or drumming patients or patronage. Michigan has a law which provides for the revocation of the license of "any of the registered practitioners who shall pay or present money, or other valuable gifts, for bringing patients to him." In 1913 the state of Nebraska also passed a law bearing on the question of fee splitting, which carries a penalty of a fine of not more than $100, and makes the physician liable to a civil action by the patient to the full amount received. As the Texas law refers to anyone who practices medicine or the art of healing the sick or the afflicted, that law could be made to apply as well to the dentist or orthodontist as the practitioner of medicine. Some of the professions, of course, object to the laity or the public attempting to run their business, or, as they say, attempting to regulate what they shall charge or how they shall charge it. We are also aware of the fact that public service corporations have in times past objected to the public attempting to regulate their affairs, but at the present time the people are succeeding and some of the public service corporations are being made to realize the errors of their ways. The question of morals, or what is right and wrong, is to a very great extent a question of education. In Missouri in times past it was considered perfectly moral, right, and legal to have slaves, but at the present time it is not so considered. It may have been considered perfectly right at one time for surgeons and physicians to split fees, but the general tendency of education is that it is not right . It used to be considered proper for aldermen, councilmen, and legislators to receive large fees from public service corporations for services rendered during the time they were supposed to be serving the people. Such a condition was known as "graft" and even graft was for sometime supposed to be right and legal—something in which everybody would engage if given an opportunity. At the present time graft is not considered right, and a great many men who were prominent citizens are taking forced vacations because of it, the finest building of Leavenworth being occupied by them, (the Federal prison). The state of Ohio, according to the *Ohio State Medical Journal*, has also passed a law regulating fee splitting, as has also the state of Kansas. Probably the Kansas law is more stringent than any other law that has been passed, and is published here in full:

Section 1. It shall be unlawful for any physician or surgeon to pay, or offer to pay, to any other physician or surgeon, or to any person in his behalf, either directly or indirectly, any fee, money, or thing of value of any kind in consideration of such other physicians or surgeons bringing to him, or agreeing or promising to bring to him, for treatment any patient, assisting to treat or operate upon any such patient so sent, or advising or agreeing, promising or promising to advise any patient to consult him, or to be treated or operated upon by him, or assisting to treat or operate upon any patient so advised; and it shall be unlawful for any

physician or surgeon who shall have sent, or shall propose to send, to another physician or surgeon any patient, or who shall have been advised, or promised or proposed to advise, any patient or patients to go to or to consult such other physician or surgeon, to demand, collect, or receive any fee, money, or thing of value of any kind, either directly or indirectly, therefor, or for assisting to treat or operate upon any patient so sent or advised; provided, however, that it shall not be unlawful for such physicians or surgeons to pay or receive such fees, money, or value where full disclosure as to the amount to be paid and received shall have been made to the patient or person liable for the fees to be charged for the treatment of such patient before such patient or person shall have paid or agreed upon the amount of the fees to be paid by them.

Section 2. Any person who shall violate any of the provisions of this act shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by a fine of not more than $500 and by imprisonment in the county jail for not exceeding six months, or both, and such conviction shall operate as an annulment of the license of such convicted person to practice as a physician and surgeon in this state.

Section 3. It shall be unlawful for any person, firm, or corporation owning, operating, or controlling any hospital in this state to pay, directly or indirectly, to any physician or surgeon any commission or consideration of any kind whatever for advising any patient to go to such hospital for treatment or operation, or for bringing any patient to such hospital for such purpose.

Section 4. It shall be unlawful for any physician, surgeon, or hopsital to demand or collect any fees or charges from any patient in any case in which there shall have been a violation of this act.

The dental profession may feel that they have been favored in the wording of this law, as the law plainly states, "physicians or surgeons." We are more or less familiar with the acts which were responsible for the passing of this law, and somewhat familiar with the discussion that occurred during the time this law was being enacted, some of which discussions were really amusing if the subject had not been one which demands a more serious consideration. The Kansas law was enacted because of conditions which developed in a certain town in which a young surgeon, with more than ordinary ability, came into the town and in a few months succeeded in building up a large practice, much to the disgust of the older men, because he paid commissions, some as large as 50 per cent of his fees. The older surgeons immediately became active, principally as a matter of self-protection. The advice of the legal profession was secured, and this law was made, after the suggestion of the judges of the Supreme Court, in such a manner that it supposedly will stand the legal test.

We were present at a conversation that took place among some medical men and lawyers at a club in the state of Kansas. There was present in the group a surgeon of considerable ability, who had in times past paid commissions or fees to men who sent him business. There was also present a prominent lawyer, who vehemently denounced the practice of division of fees or paying commission, or, as he called it, "fee splitting," among medical men, claiming it was not right, and of course was working for the passage of the law to regulate the practice of the medical profession. Now, if anything is amusing, it is the legal profession trying to regulate the medical profession, or in other words, the judge trying to regulate the morals of a surgeon. The surgeon said, "Judge, is it not a fact that there is fee splitting going on in the legal profession at the present time?" The judge replied, "Certainly, it is right there should be." But, being ordinary orthodontists, we cannot understand why it is any more morally right for the legal profession to split

fees than it is for the medical profession to split fees. We had, however, the peculiar condition presented of a judge advocating a law prohibiting something in one profession, and at the same time admitting a similar thing was being practiced in the legal profession, and he tried to prove it was a perfectly right thing for him to do, being a judge, but still it was not right for the surgeon to do a similar act. It will be observed from this that the question of fee splitting is one which cannot be settled by a simple turning over of the hand. It is very obnoxious to contemplate that a physician will send a patient in need of surgical treatment to the man who is paying the largest commission. The judge, however, says in effect to the medical profession that it is perfectly right for lawyers to divide fees until they have succeeded in getting all the money from a poor widow or orphan, each one demanding his particular rake-off. There is no question that a physician or dentist who sends a patient to a surgeon or an orthodontist, or any specialist, assumes a certain amount of liability, for if the operation is not a success, if the malocclusion is not properly treated, the patient or his parents will consider responsible to a certain extent the man who advised him to go to the specialist. As the general practitioner assumes a certain amount of responsibility every time he refers a patient to a specialist, it is no more than right that he should be paid for the responsibility, but the vital question at the present time is, how will he receive his compensation? We have stated what would be the proper way, but as many acts of conduct in this world are not proper, we have to follow the most expedient method that can be pursued.

We are opposed to the division of fees because we do not believe it right. We do not believe it is right because both the medical and legal profession do not want the patient to know that the fee is being divided. We are also opposed to the practice of fee splitting because of the moral effect it has on the profession, for there is a certain percentage of the profession that will refer their patients to the man paying them the largest commissions, regardless of their ability. The habit would, therefore, result in men who do not possess ability building up large practices by paying large commissions, and the public would suffer. We have known that to occur in the practice of orthodontia, surgery, and other specialties of medicine. If the dental profession is ever to be placed on the plane we hope it is to occupy, and the practice of orthodontia is ever to be the science we hope it will be, and if the public is ever to appreciate the professional standing of the dentist and the orthodontist as well as the medical man, it will be necessary for the public to realize that it must pay for professional service and advice, and the sooner the general practitioner of medicine and dentistry render bills to patients for professional services in the nature of advice, the sooner will the question of fee splitting be a thing of the past.

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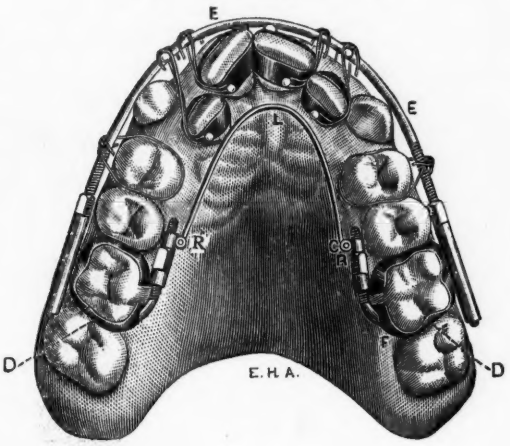

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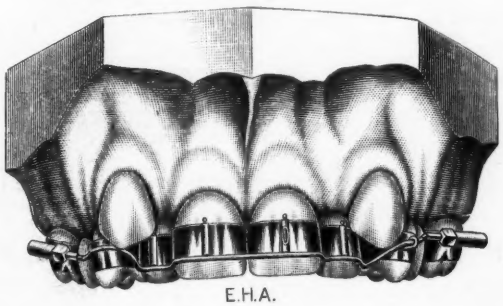

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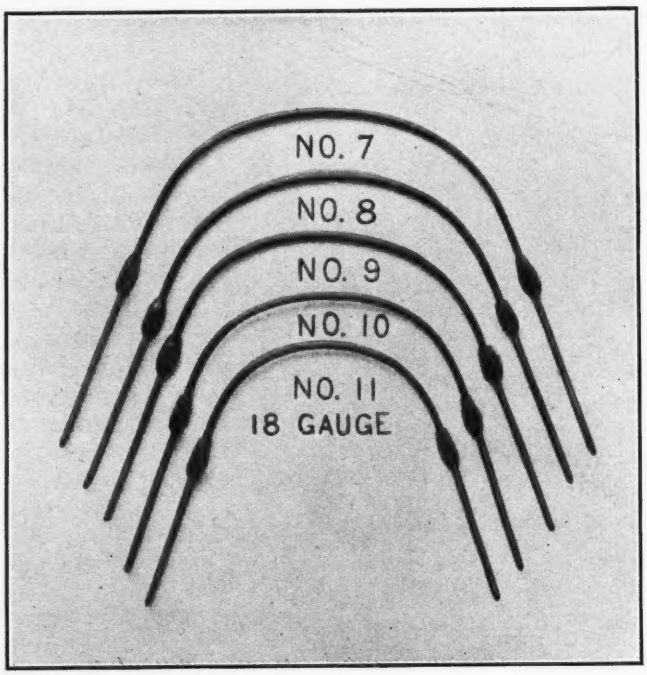

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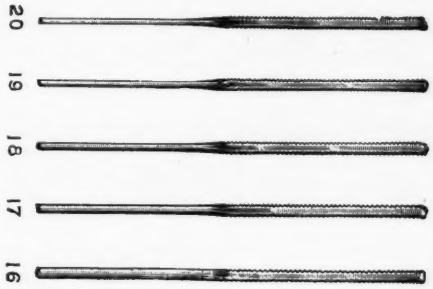

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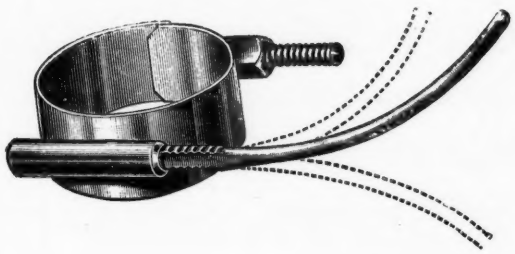

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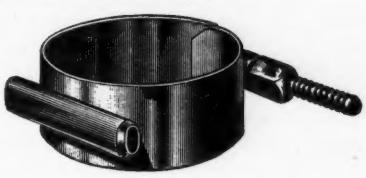

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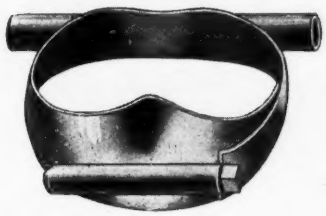

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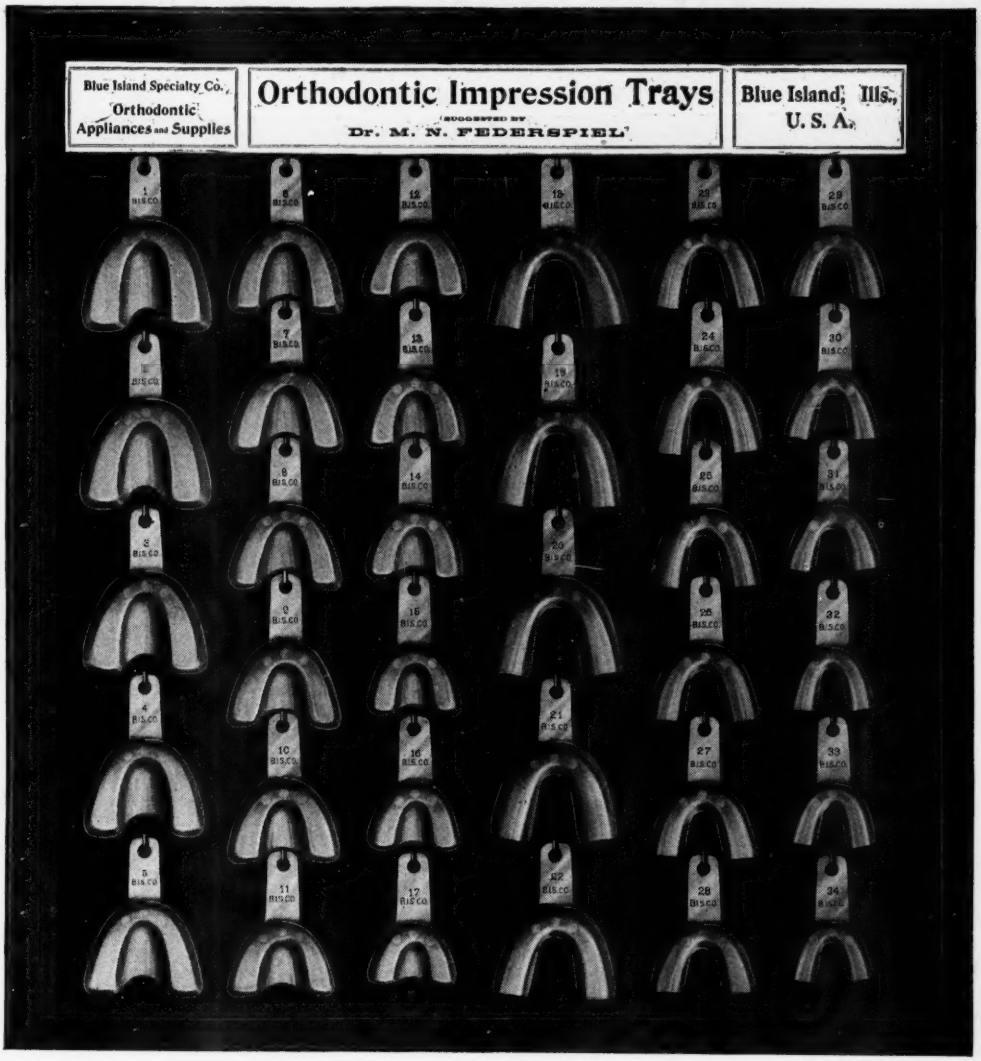

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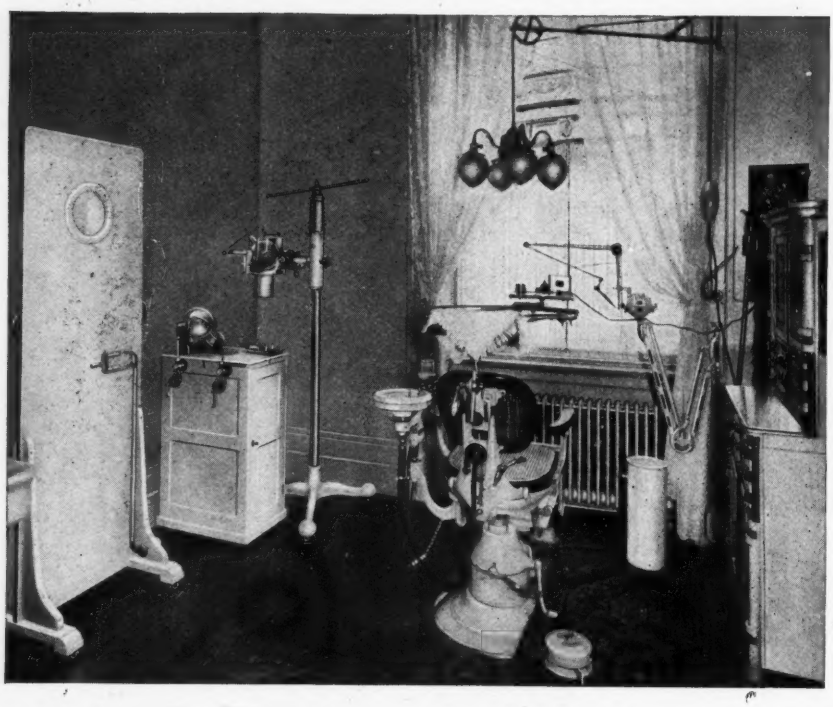

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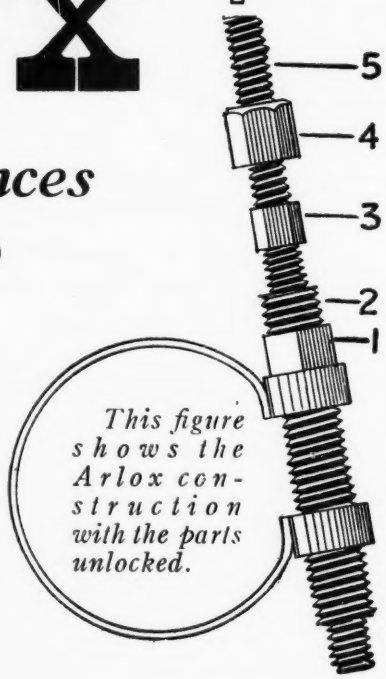

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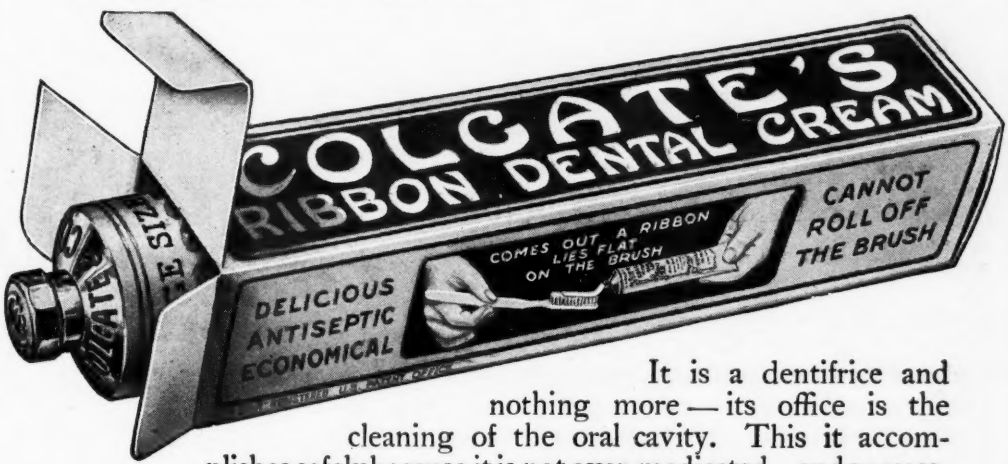

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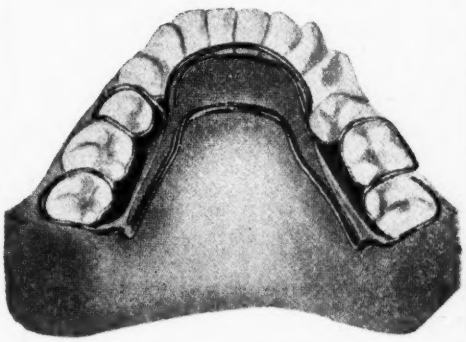

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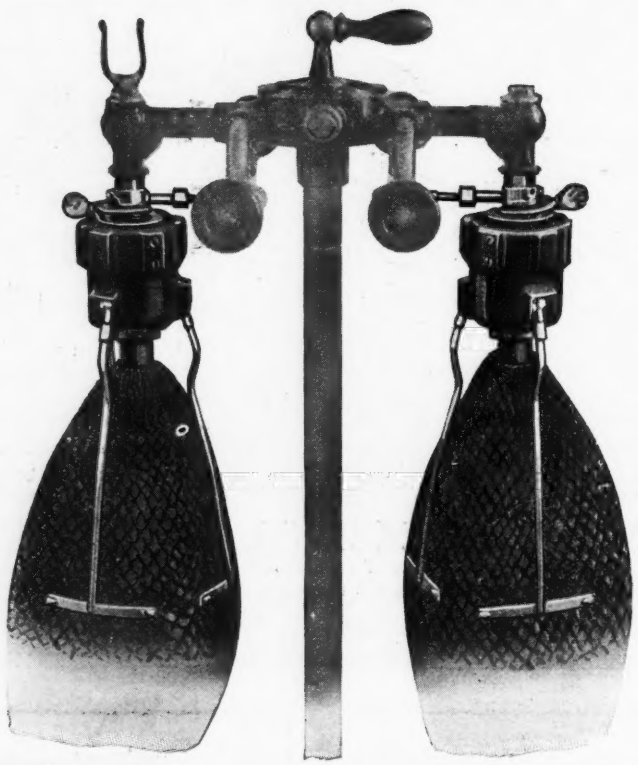

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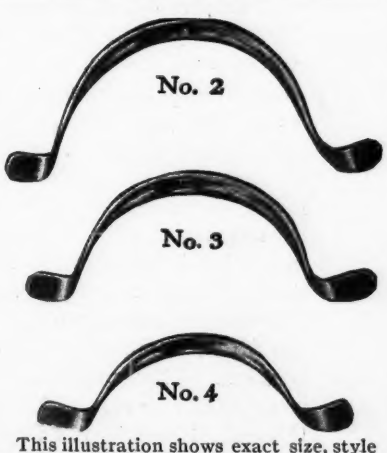

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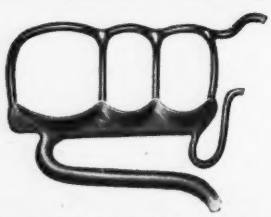

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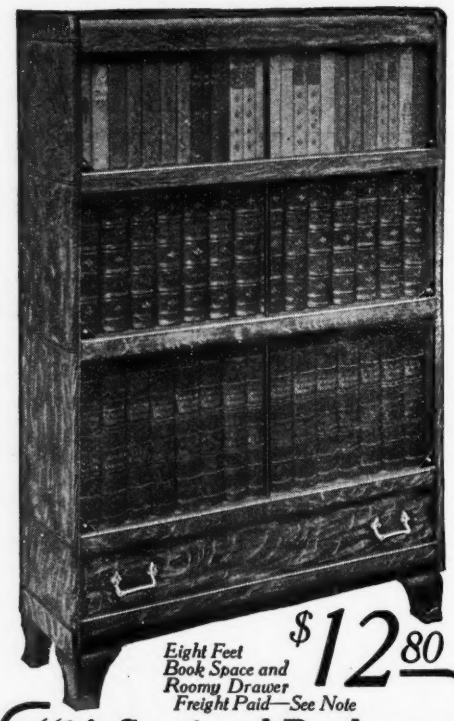

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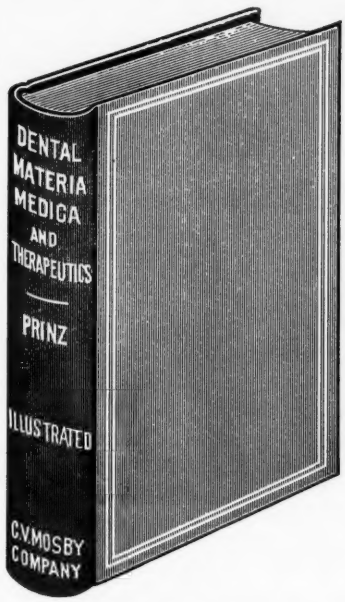

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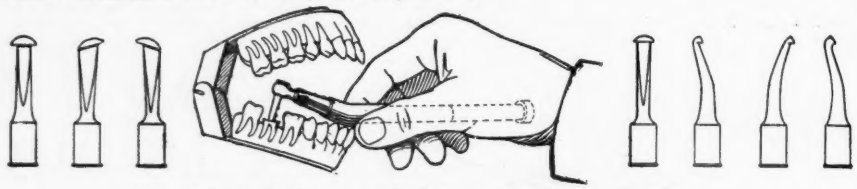

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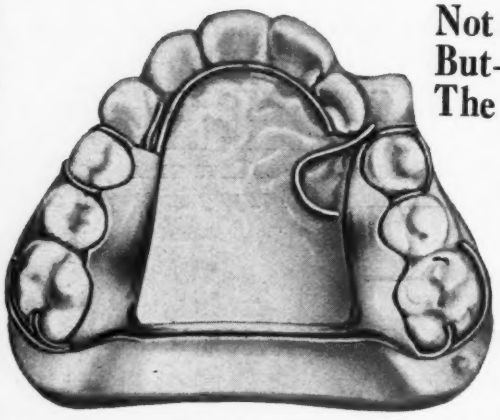

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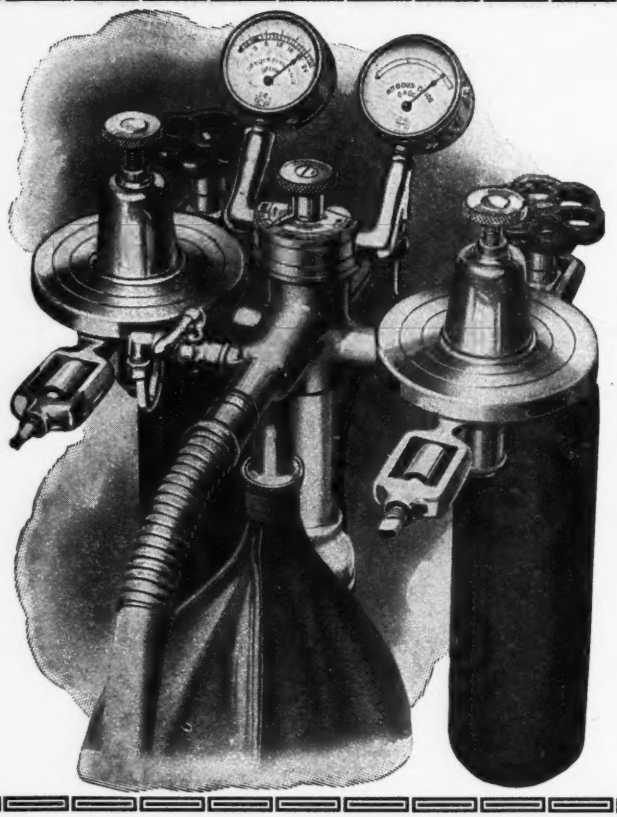

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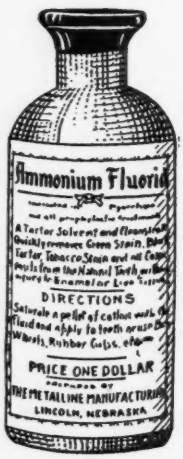

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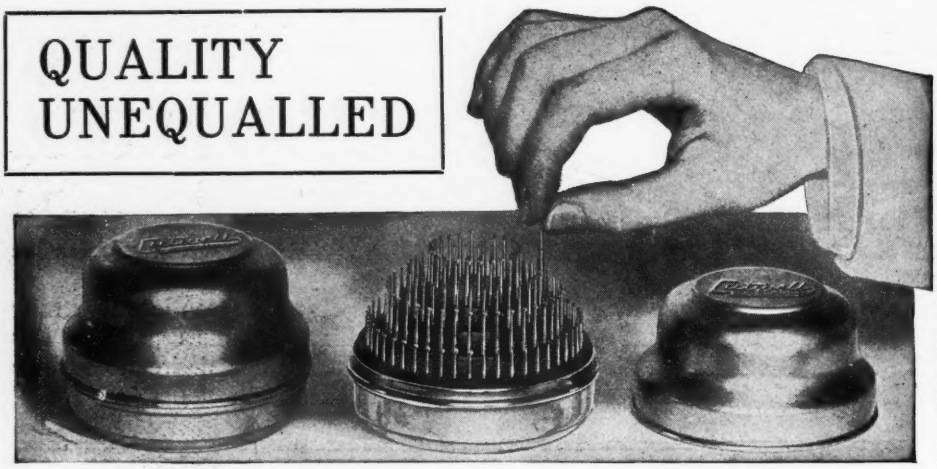

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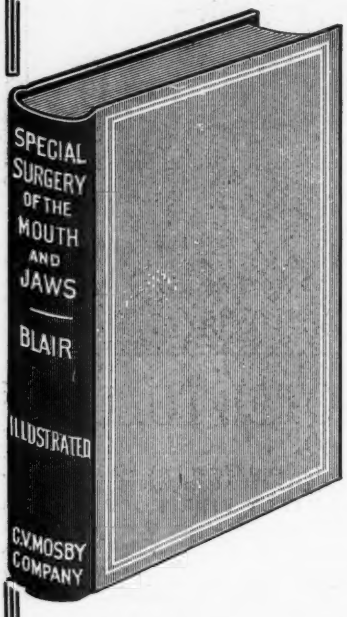

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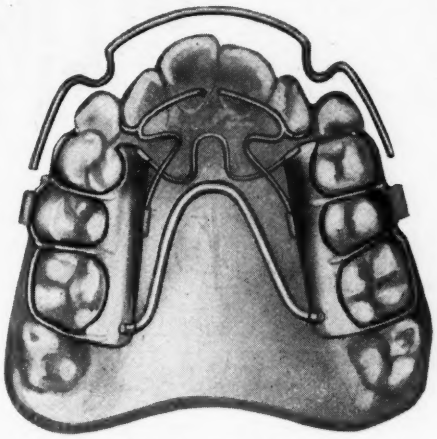

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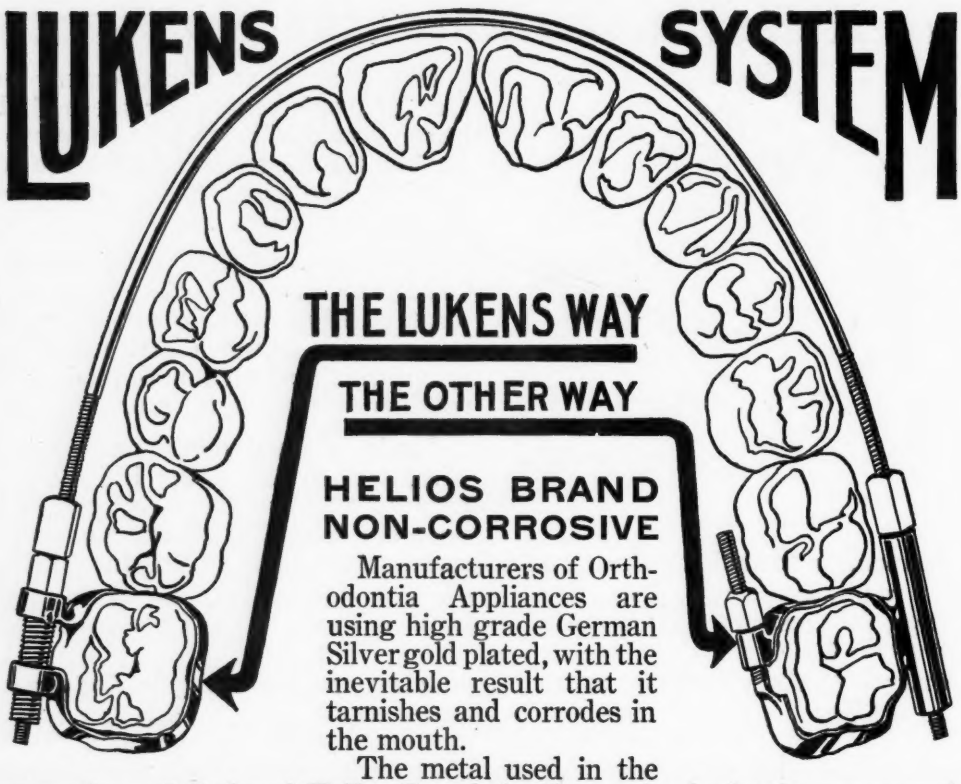

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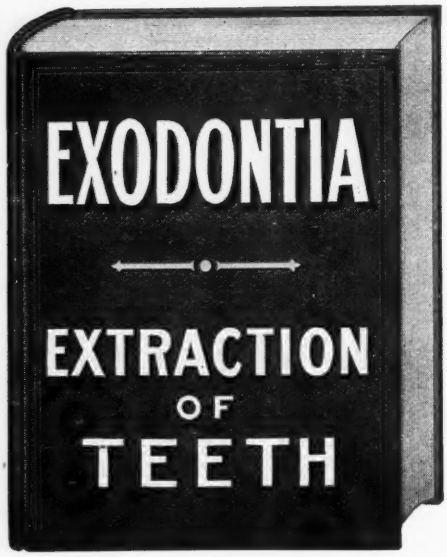

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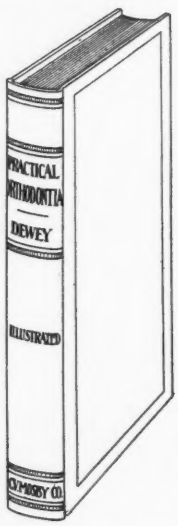

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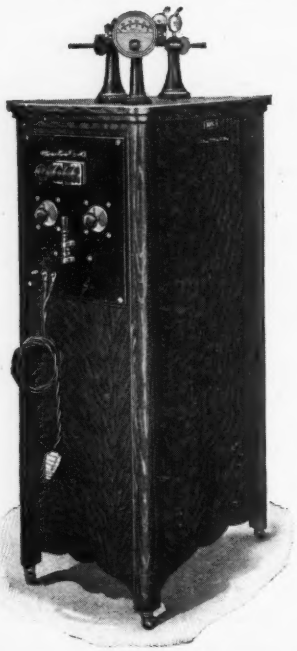

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Dentalone is useful as a solvent for arsenic paste in pulp-devitalization. It counteracts the pain without interfering with the chemical effect of the arsenic upon the pulp.

Dentalone, mixed with zinc oxide for the filling of root-canals, exerts both an anesthetic and antiseptic effect. The chloretone and oil of cloves possess antiseptic properties, while the combination as a whole serves as a useful local anesthetic.

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